

INCORPORATED



AUGUST 31, 1964

The Society of Air Safety
Investigators

**FIRST ANNUAL
INTERNATIONAL SYMPOSIUM**

"Investigation Is The Keystone Of Progress"

1970

Air Transportation Consultants
P. O. BOX 7351
ALEXANDRIA, VA. 22307



**THE SOCIETY
OF
AIR SAFETY INVESTIGATORS**

presents

**“Investigation is the
Keystone to Progress”**

The First International
SASI Seminar

November 2-4, 1970

Sheraton-Park Hotel
Washington, D.C.

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Agenda

MONDAY, NOVEMBER 2

Registration

8:00-9:30 A.M.

2:00 P.M.

SESSION 2

9:30 A.M.

WELCOME ADDRESS

Jerry Lederer, *President*, SASI
Russel Watts, ICAO
C. O. Miller, NTSB

"Roll of Interested Parties
In Accident Investigation"

Moderator, Jerry Lederer, NASA

Panel Members:

Mr. G. C. Wansbeek, Netherlands
Mr. E. R. Banning, ALPA
Mr. W. Becker, ATA
Mr. Prater Hogue, Boeing
Mr. Roys Jones, AOPA
Mr. J. F. Rudolph, FAA
Mr. G. Haddaway, Flight Magazine

10:35 A.M.

SESSION 1

"Aircraft Accident Investigation . . .
Organization and Planning"

Moderator, C. O. Miller, NTSB

Panel Members:

Mr. R. Fawcett, Canada
Mr. Frank Yeend, Australia
Mr. W. H. Tench, United Kingdom
Mr. P. G. McCabe, Ireland
Mr. Roys Jones, AOPA
Mr. Richard Sliff, FAA

3:30 P.M.

SESSION 3

"Accident Investigator's Role . . .
Public Relations and the Press"

Moderator, George Haddaway, Flight Magazine

- a. "Government Viewpoint," Edward Slattery, NTSB
- b. "Press Viewpoint," Jerry Hannifin, ASWA, and Robert Serling, Author

Panel Members:

Mr. Robert Serling, Author
Mr. Vernon Hougland, AP
Mr. W. H. Tench, United Kingdom
Mr. J. R. Greenwood, FAA

12:00 P.M.

LUNCHEON

Speaker, Goerge Haddaway, Flight Magazine

5:00 P.M.

ADJOURN

TUESDAY, NOVEMBER 3

9:00 A.M.

SESSION 4

"Typical Accident Investigation
and Associated Problems"

Moderator, Carl Christenson, UAL

- a. "Accidents occurring in Populated Areas," Van Epps, NTSB
- b. "Accidents Occurring in Mountainous Areas," W. Lamb, NTSB
- c. "Accidents Occurring in the Sea," T. Saunders, NTSB

(Covers notification, on-the-scene investigation, security, search and recovery, and inquiry.)

10:30 A.M.

SESSION 5

"Conduct of an Investigation
. . . Part I"

Moderator, Marion Roscoe, NTSB

Panel Members:

Mr. G. R. Baker, NTSB
Mr. P. Guillevic, France
Mr. Prater Hogue, Boeing
Mr. D. Madole, Attorney
Dr. Salas Parra, Venezuela
Mr. Donald Kemp, FAA

12:00 P. M.

LUNCHEON

Speaker, David D. Thomas, FSF

2:00 P.M.

MOVIE

Space Shuttle, NASA

2:30 P.M.

SESSION 6

"Conduct of an Investigation
. . . Part II"

Moderator, B. Doyle, NTSB

Panel Members:

Mr. Lloyd L. Kelly, Singer/Link
Mr. M. Bates, Douglas
Mr. J. Childs, NTSB
Mr. R. Rudich, NTSB
Mr. B. Hopper, NTSB
Dr. Albert Cierbeij, FAA
Mr. Thomas Collins, FAA

5:00 P.M.

ADJOURN

Reception — Banquet

Cocktails — 6:30 P.M.

Dinner 7:45 P.M.

Guest Speakers:

Governor J. Reed, NTSB

Jerry Lederer, NASA

WEDNESDAY, NOVEMBER 4

9:00 A.M.

SESSION 7

“Accident Reports . . . Development and Use, Collection, Recording, Retrieval and Dissemination”

Moderator, M. Hollowell, NTSB

Panel Members:

Mr. Russel Watts, ICAO

Mr. David Kelley, NTSB

Capt. M. D. Brandenburg, Germany

Mr. John Carroll, NTSB ✎

Mr. J. Ralph Horn, FAA ♣

10:30 A.M.

SESSION 8

“Accident Investigator and His Problems”

Moderator, Frank Yeend, Australia

Panel Members:

Mr. Marion Roscoe, NTSB ✎

Mr. Sam Parsons, NTSB ✎

Mr. W. H. Tench, United Kingdom

Mr. C. Grimes, NTSB ✎

Mr. Frank Yeend, Australia ♣

Mr. A. M. Tibbs, FAA ✎

12:00 P.M.

RECESS

2:00 P.M.

MOVIE

Aircraft Accident Investigation, Air Force Lunar Landing Training, NASA

2:30 P.M.

SESSION 9

“Unusual Investigations and Programs”

Moderator, Frank Yeend, Australia

a. “Apollo 13 Investigation,” C. McGuire, NASA

b. “Investigation of Wide Body Jets,” E. V. Nelmes, NTSB ✎

c. “Unusual Investigation Situations,” Frank Taylor, NTSB ✎

3:45 P.M.

SESSION 10

“Special Problems Associated

with International Accident Investigations”

Moderator, Robert Froman, NTSB

Panel Members:

Mr. R. Fawcett, Canada

Mr. Frank Yeend, Australia

Mr. P. Guillevic, France

Mr. P. G. McCabe, Ireland

Mr. S. Ohsawa, Japan

Dr. Salas Parra, Venezuela

Mr. W. H. Tench, United Kingdom

Mr. Donald Kemp, FAA

5:00 P.M.

ADJOURNMENT

GENERAL INFORMATION

Exhibits

Message Center and

Reception

Seminar Sessions

* Luncheon & Banquet

Restaurants: In addition to dining facilities at the Sheraton-Park, there are several restaurants within walking distance of the hotel.

Maryland Suite

Main Lobby

Maryland Suite

Delaware Suite

Seminar Staff:

C. O. Miller

James Childs

E. A. Goff, Jr.

Robert Froman ✎

Kenneth Scamahorn

Charles Connaway

Thomas Collins

Jimmy Behram

Seminar Director

Deputy Director

Program Chairman

Co-Chairman

Registration

Coordinator

Membership

Audio Visual

*Admission by Card Only.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

WELCOME ADDRESS

BY

Jerry Lederer, President, SASI
Russel Watts, ICAO
C. O. Miller, NTSB

November 2, 9:30 A.M.

Washington, D. C.

WELCOME ADDRESS
BY
JEROME LEDERER

Well, I want to welcome you to the first International Seminar on Air Accident Investigation. It's an experiment which we hope will go far. It was an idea promulgated by Mr. Robert Froman of the National Transportation Safety Board, feeling that meetings such as this would have the effect of getting people to know one another before the accidents occur in strange lands. You'll have an opportunity here to meet with people and discuss problem areas with people whom you will meet later when accidents occur in countries other than your own. In addition, of course, we will be able to exchange ideas on new techniques as well as the old proven techniques on aircraft accident investigation.

This meeting has been staffed entirely by volunteers, men who have many pressing duties. We have no full-time staff, and I want to acknowledge now and again later on my thanks for the wonderful job they've done in getting this together against terrific odds from the point of view of the time available.

Many of us here have witnessed aviation grow from a small beginning to an industrial giant; a giant vital to the domestic and international economy of all our nations. We have also witnessed the growth of safety from one fatality in every four professional pilots forty-five years ago to about one fatality in every two thousand pilots today. This is average for this country; about one in every two thousand people have been killed by accidents in this country per year. This is the score for the airline pilots. When I started in this game in the 1920's with the United Air Mail Service, we lost one in every four pilots every year. There weren't many lost - an average of ten per year - we only lost 40 pilots, but that was the prevailing rate and even as late as 1931-32 one in every 50 airline pilots was killed each year. So we've grown a long way.

Much of the progress in the development of safety resulted from lessons learned from accident investigation. My first investigation was in 1926. There was an airplane flown by the Ford Motor Company from Dearborn to Chicago that crashed up in Indiana and the pilot broke his back. I also was involved in air mail accident investigations. But the lessons learned from these accidents are what has led to much of our progress. There's no reason to doubt that this will continue and that new techniques will be developed to aid the investigator to determine probable causes with less time and more accuracy than in the past, in spite of the incredible growth and complexity of the vehicles. The use of flight recorders, voice recorders, x-ray techniques, improved photography, nuclear activation, improved search and rescue, better training, formalized safety engineering, the system approach to accident investigation are some of the techniques developed in the past decade or two that are transforming accident investigation from an art to a science.

But it still remains a considerable art. We are here to help each other uncover and disseminate new ideas on developments in both the art and science of aircraft accident investigation. And I'd like to say that aircraft accident investigation is acting as a prototype for other forms of transportation investigation; notably, railroad, buses and marine. I'd also like to note

that aircraft investigations have acted as a prototype for the vast interest in crash survival of automobiles. The seat belts, the energy absorbing steering wheel, the padded instrument panel, recessed knobs, lack of sharp corners, and the many other things, are all outgrowths of investigations begun originally in aviation, beginning about 1941. What is done in aviation is very important to other areas of human activity.

Aviation safety has no boundaries, and that is why this is an international forum. On behalf of SASI, I welcome not only NTSB, FAA, the military, and the press, but also IATA and ICAO, and through them, all nations to this first forum. SASI is international in its membership. There is no reason, for example, why conferences such as this should not be held on some other continent in the future. It is therefore fitting that the ICAO representative, Mr. Russell Watts, should start the forum off. Mr. Watts entered aviation during World War II as a pilot in the Royal Australian Air Force. Some five years later, he joined the Australian Department of Civil Aviation. After seven years in various aspects of air traffic control he transferred to aircraft accident investigation and has been in this profession for the past fifteen years. In the first four years he worked in the Australian Central Office, followed by a period of ten years heading up a field office responsible for air safety investigation in one region of Australia. This involved the investigation of all accidents and incidents, ranging from the Boeing 707 to the Tiger Moth gliders, parachutes and even hot-air balloons. In June 1969 he joined ICAO as Chief of the newly formed Accident Investigation and Prevention Section, based in Montreal, Canada.

He holds licenses in fixed wing and helicopter aircraft.

Mr. Watts.

RUSSELL WATTS

Mr. Lederer and gentlemen, first of all I'd like to say how honored I am to be asked to address you this morning and how pleased I am to be here and to be associated with this gathering, particularly the wide range of organizations, the services and the companies which are represented. And I'd also like to congratulate the Society of Air Safety Investigators for taking the initiative in organizing this ... what is the first international forum on aircraft accident investigation. I believe that we're all aware of the benefits to be gained from personal contact with our opposite numbers in the various organizations and countries and, over recent years, I think that there's been a fair amount of travel between States and there has been an effort to have coordination between the various organizations.

But to my knowledge this meeting is the first informal international meeting of this magnitude of air safety investigators and as I said I think the Society's to be congratulated on taking the initiative. I say informal because there have been at least three formal meetings under the auspices of ICAO but the record, as you possibly know, leaves much to be desired.

The first meeting was in 1946, the second in 1947, and the third in 1965, a mere time lapse of 18 years between meetings and no more needs to be said on that, I would think.

For those who are interested, I'd guess that the fourth meeting would be somewhere in the first quarter of 1973, which, in fact, is little more than two years from now. I might add that there's been no positive arrangements made as yet. So, having made those remarks, it would definitely appear that the winds of change blow rather lightly at the international level and there's ample room to demonstrate that air safety investigation and accident investigation and accident prevention lead the key pace with an industry which we like to think of, and I believe it is, as being dynamic, it's expanding rapidly in stature and technology and its achievements. Although the ICAO world currently consists of 119 States and, if rumor has it, Russia is likely to join ICAO in the near future, but I must admit that I only have it as rumor, this represents the vast majority of civil aviation in the world. These States through the Convention, Article 37, to be precise, have agreed to collaborate to facilitate and improve air navigation and this includes investigation of accidents. And to this end, we know that we have Annex 13, Aircraft Accident Inquiry, and I believe that it's highly significant that the differences filed by these 119 States are very, very few. In other words, the countries legally have expressed their willingness to cooperate in the international field, particularly in the international field of accident investigation, and they have provided the tools for this by means of standards and recommendations. International cooperation both in the field investigation and in matters relating to exchange of information assumes more importance every day, particularly if we are going to talk about accident prevention. I think we talk too often about accident investigation. Possibly we need to update the tools which we have available to us in the international field, as they were last reviewed in 1965. And I believe it is this type of forum at which we're present today which enables us to get together, informally, and it provides an opportunity to formulate some needs and thoughts so that at some later date

we can come together in a more formal atmosphere and get the tools that we need. I don't intend to talk too long this morning, but there are one or two things I'd just like to remind you about and to leave you with a few thoughts.

We already have quite a comprehensive agenda before us for the next three days, today and two more, but whilst we're discussing this agenda, I believe that every person here should keep in mind our endeavor to consider the international aspects and ask himself, "Do we need this information or this action at an international level? If so, are we getting it at an international level? And if not, what should we do to get it?" For instance, I'd suggest to you that Annex 13 reporting specifications require review if we are truly interested in air safety and accident prevention, rather than mere reporting. Internationally we need to achieve a more uniform understanding of terminology. A couple of instances which come to mind such as the definition of an accident for a start, substantial damage, serious injury, these are quite important when one gets around to the more legal aspects of international cooperation.

I think also that internationally we should be working more toward compatibility of classification and coding systems of air safety information in order to improve the exchange of information between the various countries. On flight recorders, and this includes flight data recorders and cockpit voice recorders, in my view they should be considering, at an international level, utilizing the information that we have from you people. You're the experts in this field. You use them. And we've all had considerable experience, some States more than others. We should be using this expertise at an international level to come up with some type of recommendations or standards or agreement.

And I would like to press this point because in the past flight recorders have been basically discussed by the people who have been responsible for operational standards, the people responsible for the airworthiness standards, and if you don't inject your technical expertise you'll find yourself working with information for recorders designed for other than accident investigation purposes. One might also suggest that you should use your expertise as to whether these things should be ejectable, and if so, how. If not, somebody else will do it for you. And your knowledge is better than theirs from an accident investigation point of view. I'd like to remind you that flight recorders are a likely subject for discussion at the 7th Air Navigation Conference proposed for Montreal in the first quarter of 1972. And the agenda is currently being promulgated from ICAO. I'd like you to think about statistics because if you're interested in accident prevention, then I'd suggest to you that you need statistics.

Internationally, the measurement statistics necessary to look at accidents with a view to accident prevention are all myopic systems. There was a Statistics Divisional Meeting in Montreal known as the Staff Five in May and June of this year. And this statistics meeting considered changes in accident statistical data and to the best of my belief, or the best of my knowledge, there was not one operational person or qualified person at that meeting. And certainly the delegates, very few of them, were briefed for the operational aspects of accident statistics. I think that again if you're interested in accident prevention you've got to take an interest in this field.

I'd also suggest that internationally we could assist one another in accident investigation by a far greater and a more rapid exchange of technical information. We have no system for exchange of such information. We have no system for exchange of under water recovery techniques, and certainly there are people here who have got plenty of experience. I can think of two people here from the NTSB who have been flying a few feet above the surface of the sand at a few thousand feet in Lockheed Research Vehicles. I can think of French recent experience where I saw photographs last week taken at six and a half thousand feet and I'd think are taken in this room. We have no method of exchanging this information. We have no method of exchanging the various X-ray techniques and all the other technological know-how that we have. Now why don't we have such a system? I don't know, but I think that this is a forum in which we can do something about it, at least informally.

Now possibly the first step has already been taken in that the new Accident Investigation Manual is essentially prepared by some four or six investigators from various States. We hope that this manual will be on the stands in the next two weeks. In English, I should say. French and Spanish will be some months away. Now in this new manual, the appendices - it's a loose leaf document - the idea is that the appendices will each contain some 10 or 15 pages relating to a particular subject and this is intended to be educational material and I would think that if we can get you people, through your organization or through your governments, to submit this to ICAO, we will print it. And further, if we are truly concerned with air safety why do we internationally restrict our concern and our efforts of measurement of safety to what is virtually a rare concern; namely, the accident?

Furthermore, the potential effect of accident investigation is relatively low. Although there have been substantial improvements and knowledge gained from accident investigation, it would appear that there is much more to be gained or certainly as much to be gained from incident investigation. And this is a subject that we all shy away from every time we get together. It's time we stopped backing off from it and it's time we did something about it. I believe that there are many incidents which, but for one additional factor, would have been a catastrophic accident. We do take some interest in these in some places. But also by exposing and eliminating the many minor occurrences which tend to reduce safety margins, it should be possible to achieve an operational environment in which flight crews can cope more effectively with an emergency situation. Now those of you who were present at the seminar last week where Mr. Bruggink from the Seattle office presented a paper where he talked about compromise and largely this is what we are talking about. We can achieve quite a large improvement in air safety if we look at some of the smaller things without looking at the more dramatic things and his words in conclusion, which are not necessarily mine in conclusion - I have a few more words to say - were these: "That too often we look at safety as the absence of accidents and this is a negative attitude similar to that of a law breaker who measures his success by the number of times he got away with it. Safety is a reward for sustained perfection, and perfection in aviation implies that we tackle all manageable compromises, not just things that have been earmarked by an accident." And I think that those are very true words and I didn't ask his permission to use them, but I have.

Now on this subject of incidents, the AIG Divisional Three Meeting, which was back in 1965, made a recommendation that ICAO would undertake further study of the ways in which incident material may be more adequately used for the prevention of accidents. Now five years have elapsed and neither ICAO nor anybody else has really done much about it. The subject currently is number one; it's top priority on the accident investigation agenda before the Air Navigation Commission of ICAO. In other words, I have been told to get out and do something about it, to get States to do something about it, and I hope that you'll hear a lot more of it in the near future and I hope that at this meeting and at subsequent meetings we'll stop backing away from the subject and come up with some positive discussion. And finally, though this by no means exhausts the list of possibilities, there is a matter of human factors or the medical input into accident investigation.

Now this is an area in which you have a very definite part to play. You can't pass the buck on this. We have a long way to go in the international field to even achieve an understanding of what this means and what it can inject into an accident investigation. And if we can achieve understanding, then it's a step towards achieving international cooperation. And I suggest to you that as the experts who need this knowledge, who have had experience, mostly I would think unfortunate experiences because there are very few States to my knowledge who really utilize this information, who have managed to get their State laws into line with accident investigation thinking, that you people can do a lot more in this area, and I would like to remind you or to bring to your attention that right now, and it started two weeks ago and it's now in its third week, there is a meeting in Montreal known as the Palmed Training Divisional Meeting, and there are 50 to 60 doctors sitting up there discussing various aspects, including one of which I go back to next week as Secretary of an item of the human factors and pathology in aviation. This is an endeavor to get some international cooperation in this field.

And I would like to think that these doctors were briefed by you before they went there, and if they weren't briefed this time I'd certainly like to think they are briefed next time, because I believe this is a part you have to play. And I would like to mention that ICAO is doing something in this area, that in the new manual we have a section on human factors. Unfortunately, it didn't quite make the printers and I decided not to hold the manual before it went out so it will come out within the next few weeks as an addition to the manual. There is a new medical manual being formed which will include what medical people should do, in the language that they can understand, to assist us in accident investigation, rather than pure identification.

Also, the Secretariat of ICAO is liaising with INTERPOL and telling them what we want from an accident investigation point of view, both from a medical aspect and a wreckage aspect to try and get some better understanding in the various police forces throughout the world on ICAO requirements. Now most of these remarks I have made have been directed towards government people, I must admit. We have a number of people from the services here and I think that certainly there is cooperation between the services in some States. I'm not aware of any great cooperation between services and ICAO in the international field. I think this is something that should be developed, certainly where we're operating similar aircraft in similar environments. On the airlines, they have their system of international exchange, they have a representative at ICAO, they have the opportunity to inject whatever they wish into any technical meetings at ICAO, and they do a very good job.

There is one area where I feel that they could reciprocate to a much better extent than they do at the moment and you people can do something about it because you're the investigators and if you are interested in safety, you are interested in spreading the information, you'll see that information which is currently fed to IATA will reach everybody and not just members of IATA. Now internationally none of these matters that I have mentioned are insurmountable. If you're really interested in accident prevention, and as I said earlier, I think we're often too interested in accident investigation and we forget the prevention, we give it token acknowledgement, it should be possible for you to inject some substance into the statement that aviation knows no boundaries.

And in closing, I would merely like to say that I anticipate that this will be a most interesting forum. I wish it every success, and I sincerely hope that the ideas and enthusiasm which may be generated over the next few days will not disappear into oblivion on the way home. Let us endeavor to produce some positive results, particularly in the international field, as well as enjoying the intangible benefits of the personal contact provided by this forum. Thank you very much.

JERRY LEDERER

Mr. Watts has laid down a challenge, both to investigators everywhere in governments as well as in SASI. He's outlined a program to SASI that will keep us busy for many years. I think SASI's position here should act as a catalytic agent to see to it that the ideas that he has mentioned are adopted. Those that are approved. I guess they'll all be approved.

He referred to human factors in accident investigation. There is a very fine paper prepared for the NTSB and later on I would like to know what the status of that paper is. That's about human factors in accident investigation and I think that Mr. Bruggink had a large part in preparing this. In connection with police cooperation, it's interesting to know that in this country the various states have state police that investigate small plane accidents or take part and are helpful to the U.S. Government authorities. In 1948, the Flight Safety Foundation saw this was coming and held the first meeting ever held on trying to train accident investigators in the art of accident investigation. It was held in what was then known as Roosevelt Field in New York. We had about 50 or 60 people there and the only person who was an instructor at that time in some aspect of accident investigation who is here now is Dixon Speas over there, who now has his own organization of R. Dixon Speas Associates. We had an interesting week of trying to explain to state troopers who were involved in an automobile accident investigation the art of airplane accident investigation. Mr. Watts referred to safety as being an inappropriate word, or he implied that. We in NASA prefer to use the words, "risk management" to the word safety and I can get into this some time if you want me to, why we do this.

On the matter of incidents, every day I get from one airline a list of some 15 incidents that have occurred within the last 48 hours in the airline. I don't know how many other people get it but this is a kind of work which can be very valuable. The exchange of information which I guess Mr. Wansbeek and others will discuss is vital and done in a haphazard manner, I agree.

Flight recorders and other recorders and other instruments I noticed yesterday's New York Times said the FAA may require a crash signal device on all light airplanes which would cut down the length of search and rescue to a very considerable extent, although it does have problems of going off inadvertently and arousing false alarms.

Well, now we come to Mr. Chuck Miller. He is Director of the Bureau of Aviation Safety of the National Transportation Safety Board. He is thus responsible for the investigation and reporting of all civil air accidents and numerous accident prevention activities having to do with his work. He is former Director of Research and lecturer at the Institute of Aerospace Safety and Management at the University of Southern California. He was previously associated with the Flight Safety Foundation as Special Assistant to the Director, which was myself, and prior to that, was with Chance-Vought Corporation, now Ling-Temco-Vought, as a test pilot and Chief of Systems Reliability in the Engineering Department.

He holds a B.S. degree in Aeronautical Engineering from MIT and an M.S. from the University of Southern California in Aerospace Management. Prior to joining government service in August 1968, he held numerous consulting positions with industry and government agencies in both aeronautics and astronautics. He is the author of 35 professional papers and the first text involving system safety.

A native of Cleveland, he graduated from Glenville High School there in 1942. He mentions the word systems reliability. People often confuse reliability with safety.

We make a distinct difference of that in NASA because, you may recall, in 1967 there was a fire that killed three astronauts. They couldn't get out of that hatch; it took too long to open, that hatch was very reliable. It always opened when you wanted it to open but it didn't open soon enough and that's the difference between reliability and safety. One difference. There are very many other examples that I could give you.

Chuck, will you take over?

CHARLES O. MILLER

Just a postscript on that systems reliability. We were looking around for years for some kind of a term to include things such as air safety, human factors, maintainability and what I call small error reliability; which, I think, is a connotation of NASA, and this is what systems reliability meant to us at that time. I am sorry we ever used the term. Believe me, safety was a large part of it.

The program, gentlemen, shows me as Seminar Director. I can't help but think this is sort of an honor as much as anything, because we have been fortunate to be here in Washington and perhaps supply some of the support services to this very, very worthwhile forum.

What I'd like to do though, immediately, however, is recognize the gentleman who has been really putting the major part of the work in, Jim Childs. Jim is listed on the program as the Deputy Seminar Director, and it's indeed a pleasure to work with a guy like that and I'll tell you why. People that have programs like myself here are looked upon as being the thinkers of the world. As a matter of fact, people that have a little spot on the back of their head like I have, they are thought of as the lovers of this world. Now, if you'll look at Jim, you will find that he thinks he is a lover, and it's a delight to be around people like that.

I have only one problem here at the Sheraton Park. It's entirely too close to 1626 K Street, where NTSB has its home. So, you may or may not be able to catch me all the time, but I am sure Jim can solve your questions or problems for you, as well as people like Bob Rudich, Sam Parsons, and the rest of them who are here from the Board. And I hope, in case I forget later, to emphasize it's open house all week and for any and all people to come down and see. We'd love to have you drop by.

Now, as far as the program is concerned, I wanted to call your attention to the overall sequence of events here, too. In other words, this morning after the coffee break, we will be essentially concentrating on what takes place before the accident occurs, from an organization and planning point of view. Later on today we get involved with who really participates in these things, the parties to the investigation and then certainly the involvement of the news media, which is a major part of our efforts one way or the other. Tomorrow we look into somewhat unique environmental problems that you face in the investigation task and indeed spend a good share of the day in the dirty details of the investigation science/art that Jerry Lederer talked about and Russ Watts did also. Wednesday we will talk about the development and use of reports and the data that are generated therefrom. We get into a sort of personal viewpoint of the investigator and certainly touch upon unusual investigations, including those geared internationally. Now I stress this. Your knowledge of what I'd like to have you keep in mind is the overall scope of the program here because we do like to keep things as informal as possible and we're going to try to stress a lot of questions. If you can keep certain questions to the most appropriate part of the program, I think it will be most beneficial. In other words, we may be talking about planning, but lets not get into one of the unique things about mountain investigations until we get to that section. Do you see what I mean?

We are going to be asking our speakers to spend about seven or eight minutes of remarks on topics of his choice. Each speaker will not necessarily touch upon the same points; indeed, I'd be surprised if they did. What we're really trying to do is lay the ground work for a good discussion. Now, when the discussion takes place, I'd appreciate it if you would get to one of these microphones in the center and we'll have somebody ready to hand the microphone to you with the idea in mind of identifying yourself and your organization so that when we do transcribe the proceedings we'll have a complete story. And as Jerry mentioned, we do have this planned. Part of the registration fee, I might add, is going to a record of this meeting.

Just a personal observation or two concerning the theme. You'll notice the theme is entitled "Investigation is the Keystone to Progress." This brings to my mind, at least, the thing that we at NTSB seem to be continually trying to explain to people here in recent months and certainly the past year. I refer to the relationship between accident investigation and accident prevention. It's been my view, and I'm sure many of you must recognize, that accident investigation is part of the prevention process. However, accident prevention by no means is limited to accident investigation. Most of us at the Board feel and try to get across to people that what you're really looking at here is some type of a closed loop process. In other words, if everybody did his job precisely, correctly, everyone designed the product right, if everyone trained his people right, if everybody operated his people right, in other words, if everybody who is working for safety did his job perfectly, then indeed there would be no accidents. There would be no investigations.

On the other hand, we do live in a very real world. We live in a world of imperfections, not deliberate. At least the deliberate imperfections are very, very small, but they're imperfections nevertheless. And I think if we realize that what accident investigation really is in this process is the feedback loop, it's the thing which in a sense measures our overall progress in aviation and, recognize, it isn't accident investigation or prevention. What it really is, accident investigation, is part of an overall closed loop process to permit us to improve the basic thing we're working at and that's air transportation for those of us in the civil side survey. I get very concerned, frankly, when people try to argue this or that part of an overall accident prevention process. Every single bit of it is as important as the other and what we are really doing is taking a microscopic view of the thing which, well, without it I don't know how you improve.

I personally looked forward to this particular meeting. I have been for some time. We have made it a point to get as many of our people out here as our workload will possibly permit. I do hope sincerely that a lot of you can meet our staff. There are many of them throughout the audience and again, there's an open house at NTSB while you're here in Washington.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 1

November 2, 10:35 A.M.

"Aircraft Accident Investigation ...
Organization and Planning"

Moderator: C. O. Miller, NTSB

Washington, D.C.

SESSION 1

"Aircraft Accident Investigation ... Organization and Planning"

MR. C. O. MILLER

Gentlemen, we are going to proceed immediately into the program this morning with the first of six speakers you see seated here at this table. We are going to forego the normal biographies. I think most of you know these gentlemen. You will at least by their titles and their activities, and let's get into it right away.

The first is Mr. Hal Fawcett. Hal is the Superintendent of Aircraft Accident Investigation Operations with the Ministry of Transportation in Canada. Hal, you're on.

MR. R. FAWCETT, Canada

I won't waste time on formalities and I will get immediately into the subject. When looking at the subject matter, Aircraft Accident Investigation ... Organization and Planning, I placed a modest interpretation on these two words and I will speak about our convictions in these areas.

Any group charged with the responsibility of investigating aircraft accidents must have a point of origin for all of their activities if they are to plan and organize properly. This point of origin must be the determination of an aim for such a group and the aim to be expressed in a positive way, as positive as possible, and must communicate the belief that accident investigation is but a means to an end and as part of a larger more important process. I suggest an appropriate aim for such a group would be to promote aviation by contributing to aviation safety. An organization with an aim such as this is then not going to be satisfied with simply investigating accidents, but also to determine the causes, to make recommendations to appropriate authorities for accidents, to prevent occurrence of similar accidents and to report to air travelers and the community at large on the performance of the aviation industry. Thus, by providing the appropriate aim for the investigation organization, we then lead into the logical breakdown of its required activities. That is, first to investigate, second to establish causes, third to make preventive recommendations and fourth to release information to the public.

It is apparent when viewing this breakdown of the organization activities that investigation is not, and cannot be, an end in itself.

Let's consider for a moment investigation as a separate activity. If the investigator has accepted the organization's aim as his own, he will know that he is investigating for a purpose. He is not investigating simply for the sake of investigating. He is a man with purpose. He will not be diverted by irrelevancy and will continue to press the investigation until he is satisfied that he has found a cause or causes which will yield to preventive action. Perhaps an example here will illustrate the point

I am trying to make. Take a simple case, and this is applicable to general aviation; it doesn't mean we are not interested in major accidents. Take a case in which the investigator is able to determine that the accident occurred as the result of a power failure and that the cause of the power failure was carburetor icing. This is frequently expressed as the cause of an accident. But it's not a cause at all. It's merely a symptom of other problems. There's plenty of scientific proof that given a set of certain conditions, carburetor icing can be produced in a reciprocating engine. A well-motivated investigator will continue to seek the answer to the questions "Why?" His answer may lie in the training of the pilot. It may lie in the quality of the information provided to the pilot, or it may be the result of the failure in the aircraft itself. Whatever the reason, the motivated investigator will continue searching until he has found a cause with prevention significance, rather than to be satisfied with repeating a scientific fact which is already universally known. A technique which we have found useful in this respect we call the Event-Link-Appraisal Network, and this system provides a graphic representation of an accident for the investigator, and it helps him to discriminate between descriptions of the individual event that grow to make up the accident sequence and underlying causes.

Another example which I can use to illustrate my point, and again it's common to general aviation, is that of a pilot on a VFR flight plan who meets deteriorating weather and decides to press on, attempting to maintain visual contact, of course. Often such pilots reduce altitude drastically and run into some obstruction such as a powerline, an antenna or a smoke stack. It's not enough for the investigator to determine if, in fact, the pilot encountered deteriorating weather. The important aspect here is the pilot's knowledge of meteorology, the information the pilot had beforehand about the existing weather in the forecast and whether or not the pilot had taken the precaution of pre-planning his actions in the event he should meet deteriorating weather or weather which was beyond the capability of himself or the aircraft.

It's our conviction that conditioning the investigator's point of view by expressing an aim to the organization which he belongs is every bit as important as providing him with appropriate technical know-how. Let's look for a moment at the effect an investigator with a properly conditioned view has upon the remaining activities of the organization. Since his investigation has been carried out with a purpose, he will have little difficulty in producing a report thereon. He will be able to see clearly which data are relevant and which are irrelevant because he can relate them to the purpose of his investigation and the purpose of his organization. As a result, he will submit a report which is complete, accurate, and free of irrelevancy. This report, in turn, makes it easier for the staff responsible for the data system to extract information for statistical analysis. Recommendations to executive authorities should virtually followup the report unassisted. And finally, the information useful to the aviation community should be readily apparent.

One additional point I'd like to make before I finish, is that proper pre-planning of many of the activities of an organization which has the clearly expressed aim are facilitated. An example that comes to mind here is our plan for major investigations which we call logically enough the Planned Investigation Program. Although this systemized approach to major

investigation operations is still evolving, we have gained many benefits from it and we expect we will gain many more as time goes by. Not the least benefit it provides is the assistance it renders to the investigator-in-charge in quickly gaining control of the situation following a major accident.

If what I have said here has left anyone with the impression that we have achieved the ultimate in organization and planning, I'd like to correct that impression. We have not. I have been speaking of our convictions and these have not yet all been converted into concrete form.

In summary, I'd like to make one point, and this is that we are convinced that an organization devoted to the investigation of aircraft accidents must be able to relate each of its activities, every one of its activities, directly to the organizational aim.

Thank you, gentlemen.

SESSION 1

"Aircraft Accident Investigation ...
Organization and Planning"

MR. FRANK YEEND, Australia

Chairman Chuck and gentlemen: May I say first of all what a great pleasure it is to be here for the First International Forum of the Society of Air Safety Investigators; and to see once again so many of my old friends from many countries in such a delightful city as is Washington. I'd like also to join with Russell Watts in congratulating the Society on the initiative and foresight in sponsoring such a forum, and I hope and feel sure this is the first of many more such successful meetings. It is also a great honor for me to be asked to address, even for a short period, such a distinguished gathering as this. I hope that the experience of a very small country "way down under" may prove to be of some interest to you. My older friends will forgive me, I hope, if I attempt to render a slightly different version of what is nevertheless an old Australian theme in the field of air safety - the importance of the incident report.

You may ask how this fits the theme of organization and planning; but I can assure you that if in this field you are serious about accident prevention, you must claim and you must organize in some manner or degree, a system which will accommodate the incident report. No one really takes issue with the proposition that we could and should learn all about safety lessons from incidents, and that, ideally, is what we would all love to achieve. I don't think in my discussions over the years that I have encountered any one person who argues with this proposition. In the existing ICAO Manual of Aircraft Accident Investigation, it is spelled out very clearly - and we all know how long that manual has been in existence - so it is by no means a new thought. It is a matter of some small regret to us, in Australia at least to this point, that an expert team does not recognize the value of the incident report. But I feel that in time there will be some recognition of that, even in that Annex.

We have had a comprehensive incident report investigation in Australia now for 25 years. But I'm not up here to say that we've had a Utopian situation by any means. Although we've been at it for 25 years, we still haven't solved all the problems associated with the administration of such a system, and so I'm not going to suggest to you that "call on us chaps and all your problems will be solved." It is a most difficult administrative problem and we're still a long way from making it work well. But over the years, it has done a tremendous amount of good, and it has contributed significantly to our air safety record. We're proud of our record in Australia. In the most recent calendar year, we had 0.56 accidents in every hundred thousand hours flying, which we think compares favorably with the world figure. The other statistic which is sometimes used around the world is the figure of fatalities per hundred million miles. We were at 0.21 by comparison with the entire figure of 0.53. It's very hard to say how much of this is due to the existence of an incident reporting system, but we who work closely with this system are convinced that it is a very significant part in the achievement of our record.

You may be interested in the size of our operation in Australia. Some of you, or most of you perhaps, have not been there. But in comparison with the immense aviation industry in the United States, for instance, it is a small operation. Just to give you some feel for the size, let me say that we had - and here I refer, of course, to civil aircraft - as of the 30th of June this year, 3,729 aircraft on the register. In 1969-70, that was the fiscal year, we investigated 304 accidents, 30 of which were fatal, involving 70 fatalities. The number of incidents that we investigated in 1969-70 were 6,979.

The definition of an incident is a problem or matter which gives some people who have looked at this problem some concern. We have a very broad definition. In fact, leaving the legalisms out, we define it as an occurrence other than an accident which involves an aircraft and which jeopardizes the safety of its occupants or of other persons. The definition is as simple as that. As you can see, it's a broad definition to allow us a great deal of room for interpretation on the part of the person who might read an accident report and the persons who are going to deal with it. Nevertheless, pilots are encouraged by educational processes to report anything that they believe to be a matter affecting safety. Whether or not it fits the legal definition is not of great concern to us. If a pilot believes he has encountered a situation which affects safety, has affected his safety, and might affect somebody else's in the future, then we say, "Let us have a look at it and see what can be done about it." In so doing, of course, we do get a fair amount of chaff, but we get some grains of wheat in it as well, and this is what we're looking for. We do have, however, in Australia, a situation in which the reporting of an air safety incident is legally mandatory. We have a legal provision, and it might be interesting if I read the terms of it to you. It's Australian Air Navigation Regulation 2741, which says, and I quote: "Where an incident occurs to an Australian aircraft, the pilot-in-command, the owner, the operator, and the hirer, if any, should each be responsible for insuring that a written notification of the incident is furnished to the Director General within 48 hours after the occurrence."

I think I should note in the definition, first of all, that it refers to an Australian aircraft, and this, irrespective of whether it is operating in Australia or anywhere around the world, places the obligation upon the pilot, the owner, and the operator of an Australian aircraft involved in an incident. It has to be a written notification, and it's got to be to the Director General within 48 hours.

The point I'd like to make about this is, you will see, of course, that there is no room for these reports being anonymous in any sense. As an air safety investigator, I do get impatient at times with people who propose anonymous reporting systems. I feel that these must be people who have never had to investigate these things, because how can you possibly investigate an account when you have no recourse to the person who has given you the initiating information? In Australia, we don't believe that an anonymous reporting system can work effectively. Of course, there are reports that we should perhaps get that we do not get. And, so far, I cannot recall any legal or punitive action against a pilot for not reporting an incident. But nevertheless, most pilots, and most of us, have a very large conscience in the safety field. It does work psychologically on the pilot because he knows very well he has a legal obligation to report. If he is found out not reporting, then, of course, his conscience is the fact of his fellow pilots, for it appears that concealing a reportable event is a thing which lies very heavily on him. And

so, if you like, we have the pressure on the pilot to report, and he takes the risk of industry scorn if he is found out not reporting a reportable incident of some seriousness. Forms to report these incidents are widely distributed throughout the aviation network in the country, and pilots are encouraged to drop them at the nearest Department of Aviation post.

One important qualification of the compulsory, or legally compulsory, reporting system is that the Director General has publicly announced that if any pilot submits an incident report which reflects some deficiency in his own skill he will not undertake any punitive action against the pilot, either by way of prosecution or license action. So long as the pilot initiates the report, even though it might reflect some deficiency on his part, no punitive action will be taken by the Director General. This has been said by the Director General publicly and is understood by the pilot community in Australia.

Nevertheless, we still only get a small percentage of the total of reportable incidents. These constitute, for the most part, reports by pilots of things which they see other people do either to them or in the conduct of the airline system. It is still very difficult for us to get the type of report I was referring to a minute ago where a pilot will put his hand up and confess to a weakness in his performance for the benefit of others. This is still a very rare event, although a percentage of them are not very useful when they come. But for the most part, we get reports about the performance of other people. These illustrate weaknesses in our airlines' operations system. We are in this industry, of course, continually faced with new situations, changing situations, involving new aircraft and operating new types of aids over new routes. These usually generate problems which are reported to us through the incident system, and we immediately take steps to have these problems ironed out. We get the air traffic control and flight service people operating ground stations in Australia to participate in the same system. They initiate the reports themselves on the same piece of paper, and it comes into the system and is handled exactly the same way as it may come from a pilot. These reports, as I say, in a year 7,000 of them, come into our organization, and I suppose it's logical to look at what sort of organization we have to deal with these.

In the Air Safety Investigation Branch in Australia, there are six regional offices and a central office. We have a total staff of 40 persons. This is investigating persons, of course. In addition to that, there are supporting clerical and office staff as well, which probably amount to the same number again. Investigating officers amount to forty. This means, of course, by simple arithmetic, about one investigator to every 100 aircraft. We estimate that the handling of incidents in Australia involves about ten man years for 7,000 incidents. In other words, 25 per cent of the total investigation in Australia is devoted to 7,000 incidents.

To conclude, the lessons that may be drawn from the Australian experience of the Ministry in this reporting system. Now first of all, it is not necessary to define an incident as precisely as some would have you believe. Secondly, we believe that an anonymous reporting system is

not the answer. It does provide some information, but it is completely frustrating from an investigation point of view. There are significant advantages, we believe, in a compulsory system, even though this may or may not necessarily lead to prosecutions. The vast majority of incidents demand very little time in investigation, but they provide useful statistics in many cases for useful study. Finally, the method that we have found most successful in getting the best response in incident reporting is by education, and we do this through the publications which I think most of you have seen.

Thank you very much, gentlemen.

SESSION 1

"Aircraft Accident Investigation ... Organization and Planning"

MR. P. G. McCABE, Ireland

I'm delighted to be here today to say a few words to you and basically the theme of my address will be what a small state does when confronted with an accident. Ireland has a population of some two and half million and over the past number of years generally we have had a serious accident about once every two years and we have two or three small accidents annually. As a result, we haven't a requirement for a full time Investigation Division. As you heard, my title is Chief Aeronautical Officer; my principal job is air ordinance, but like all good civil servants, we have to take whatever other duties the Ministry may determine and you have to do what you're told. So, therefore, as I said, we have no Accident Investigation Division, as such. As an alternative to this, the Minister has appointed four people as accident investigators, all very experienced in aviation. They report directly to the Minister, not through the usual civil service channels. When he's on an accident investigation, he has direct access to the Minister. He makes his report directly to the Minister. Our regulations are based essentially on Annex 13 to the Convention and we have an inspector's investigation. This is where the crunch comes in, Mr. Tench mentioned it. We have a public inquiry. Now the unfortunate thing about this inquiry, it derives directly from the Chicago Convention where they have used the word inquiry in the Convention, and with the French and Spanish translations, it has all the legal connotations of an inquest. So this public inquiry is conducted by lawyers with all the trimmings and rules of a court of law. We realize the shortcomings of such a public court of inquiry, and at the moment we are looking into legislation to seek some other means to satisfy public interest. There are no accident forms in Ireland. The first people to know about it are usually the Air Traffic Service. Standard operations procedures have been drawn up whereby ATC notifies one of the investigators. He gets on the phone and he gets the first person he can get on the list. He, in turn, ascertains the basic facts of the accident and gets together a team and proceeds to the scene of the accident, notifies the state of registry and the state of manufacture, and the other people that he thinks should be notified. From this point, the investigation proceeds as normal as happens in most of the States.

With true Irish hospitality, we then extend a thousand welcomes to all accredited representatives who arrive and after they get a copy, we get down to the hard work of the investigation. We have a limited amount of facilities in Ireland available for investigation purposes so we have to rely generally on the resources of our neighbors in the United Kingdom or the United States for the state of manufacture to perform analyses of flight recorders and so on, and in the past this has been given and accepted very gratefully.

Now, Ireland is situated on the Gateway to the Atlantic and as a result a number of accidents have occurred in Ireland at a lower proportion than the number of aircraft that are registered.

Now I come to a point that's rather worrying to me at the moment. With the increase in size and configuration of new generation aircraft, the cost of aircraft investigation could embarrass a small state like Ireland. Now, I'm speaking this off the cuff, I have no brief from my own department about this, because I came out here not knowing what I was going to talk about. I feel that some policy on the cost of accident investigation should be determined internationally. Now two years ago, we had a Viscount that crashed in the Irish Sea. We had some difficulty finding it. We had to contend with tides up to seven knots down at a depth of 250 feet. As a result, the cost of salvaging alone, now we haven't got the full bill yet, was somewhere in the region of a quarter of a million dollars. This is where I think that the budgeting for accident investigation - we have no budget as such. We have a nominal figure in the budget of ten pounds just to cover that. (Laughter.)

If we are to do our job properly, we have to seek to do something about this, because we don't want somebody from the Treasury or the Department of Finance, as we call it at home, looking over your shoulder while you're spending. So for what it's worth in throwing out this point about budgeting and cost of accident investigation, you can't say I want a hundred thousand pounds next year, we may not have an accident or we may have five accidents. So, these are some of the problems that confront a small State in dealing with accident investigation.

Thank you very much, gentlemen.

SESSION 1

"Aircraft Accident Investigation ... Organization and Planning"

MR. ROYS JONES, AOPA

When I first looked at the title of this panel on organization and planning, the thought crossed my mind in a flash that this was planning for an accident and, of course, I realized that it is not quite true, they are planning for an investigation. But I think Jerry Lederer will remember something that happened about 20 years ago at one of the first Flight Safety Foundation seminars that I attended, wherein an airline doctor was going into the difficulties of obtaining coffins in sufficient number on short order at the scene of a major disaster. And some impromptu humorist from the audience said, "Why don't the airlines buy them by the trainload and store them in some convenient spot?" Personally we don't plan in quite that manner.

I'd like to tell you, in case some of you don't know, about what AOPA is. The Aircraft Owners and Pilots Association in the United States is composed of about 160,000 pilots who are members of ours and who fly the great majority of the airplane fleets in this country. Nationally, we are associated with 19 other organizations which are similar to AOPA and it's called the International Council of Aircraft Owners and Pilots Associations. We are officially accredited to ICAO as observers and at this moment there are six members of the AOPA delegation in Canada talking about a RAN Division which Mr. Watts is quite familiar with. I myself have been on similar ICAO bodies from assemblies on down to small regional meetings. AOPA is, of course, quite conscious of aircraft safety. It is quite true that general aviation has 97% of the accidents. It's also true that we fly 98% of the aircraft. And in the AOPA fact card for 1969, on which the term safety, or the subject of safety, comprises about one sixth of the entire card, I note that in 1969 the United States general aviation carried approximately 171 million people. The airlines carried 144 million people. In 1969 there were 1,388 fatal accidents; and as far as general aviation is concerned, per 100 thousand hours of flight, the number is 5.6. In 1968 the number of fatal accidents or fatalities for the airlines per 100 thousand hours was 6.1. And last year, a great improvement down to 2.8. So, in general aviation, even though the numbers of airplanes are increasing tremendously, the percentage of accidents is slowly coming down. We like to think in AOPA that we have a hand in this. We have formed the AOPA Air Safety Foundation. Every issue of our pilot magazine contains the story of several accidents that have happened during the previous month. These are published merely as a preventive effort so that somebody in reading of a particular accident might not get involved in a similar accident. Hopefully, this bears results. The AOPA Air Safety Foundation conducts 30 to 40 flight clinics, training clinics, throughout the United States annually; and a new effort is called the Sky Safe Program, where for \$30 an individual can participate in an hour to an hour and a half flight check and as many as six lectures dealing with the safety of flight.

So much for our participation in trying to prevent accidents and enhance the knowledge and expertise of the pilots. In our Washington office we have a small staff, and among that staff there is a very small group of accident investigators. I am that group. It is our policy to participate as nearly as possible in those accidents, serious accidents, which involve a general aviation aircraft, regardless of whether the pilot or owner of that aircraft is a member of our association. We're especially interested where a collision occurs between an airliner and a general aviation aircraft.

Now in preparing for participation, our Executive Staff will receive notification of an accident, evaluate the items or facets concerning that accident to see whether general aviation can be involved and whether or not we can help. The staff makes a decision and I am usually asked to go and my only preparation, gentlemen, is to be sure that I have an air travel card in pocket all the time and perhaps a spare shirt in a small suitcase. We notify the Board and proceed to the accident site. This afternoon I will tell you what we do there so I won't take your time this morning.

Our preparation for a Board hearing in case the Board decides to hold a public hearing is somewhat more expansive. The group is doubled. The participants are the Washington Counsel and myself. The Washington Counsel is the spokesman and I offer whatever technical advice and expertise I am capable of. The hearings of course are non-adversary in type and our only objective is to do the best we can to see that the facts of the case involving the general aviation involvement are presented as truly and honestly as possible. Our preparation of course is a detailed and thorough study and analysis of the exhibits and our own analysis is made to guide us in those hearings.

SESSION 1

"Aircraft Accident Investigation ... Organization and Planning"

MR. RICHARD SLIFF, FAA

I want to talk for a minute about how we play the role on the FAA side. I think of the safety investigation and the administration of safety matters as a check and balance system. There has been lots of criticism, particularly from people who are not necessarily either expert or on the inside of the safety matters, of the attitudes and responsibilities of the individuals that are involved in these activities. I like to feel that we at the FAA complement the NTSB. As most people are aware, they are charged with the responsibility of accident investigation and reporting and probable cause. But without an outlet, without a means of carrying out safety objectives, their words, their reports and everything would ring upon hollow ears.

My responsibility in the FAA, assisting in the directing of the Flight Standards Service, is to promulgate the rules, establish the policies, to give out the general guidelines relative to the airworthiness of aircraft, the qualifications of airmen, the certification of operators, flight schools, and in that light, it is our responsibility to pursue vigorously preventive measures in safety. So, we think of our role as bordering more on accident prevention and taking safety measures to prevent similar occurrences from accidents. We have the ability. We have the law and regulations which allow us to step swiftly into a situation and require certain types of action as a situation would dictate. Of course, one must be careful that one does not act precipitously and create a worse situation or create an unnecessary situation by such accidents. In this light, we participate in accident investigation and set the policy and guidelines for our field investigators.

Delegated to the FAA are some 5,000 accidents a year. I don't say that number with pride. I merely say that number as a matter of fact. We would like to see that number tremendously reduced, and we are working vigorously to do this. I think, though, it can be reduced, however, we do have a limited staff and limited budget too, though not quite as small as my friend, Gerry McCabe.

We find that many times we are involved in issues that not necessarily should be considered in the accident category. We would like to see some of these "fender benders," so to speak, eliminated from the category of accidents. We'd like to see these where they are handled in a more routine manner, so that they don't consume the time we believe could be devoted to the larger picture. We think that the safety picture and prevention of accidents requires a system approach. It requires modern techniques, computers. It requires detailed analysis by experts. It consumes time of many individuals, and all the help we can get, we need. And we do get much help from organizations like Roys Jones spoke of in the AOPA with their safety clinics and their safety programs which they have instituted. But this is not enough. Safety is an additive. To achieve the proper safety concepts, you must think it. You must act it constantly, and we feel that you have to reach the real safety-concerned people. The people that really need to be concerned with safety.

So, there's two sides to the coin. And in this particular area, we have set up an accident prevention specialist program in all of our district offices throughout the United States. We experimented for two years in this program in two of our regions. We found the results very encouraging. We found the results were really promising to develop into a far more mature approach to safety.

We hope that during this symposium you can have more detail on this. I won't take up the time of going into detail now, but we have expanded this program this year to the entire United States. We feel that the attitudes developed by having accident prevention specialists in all of our district offices can bring to the people a more effective safety program. We feel, also, that by looking into a modern aircraft now, such as the 747, the coming DC-10's, 1011's, our past experience with the jets, we can approach these by a far more intelligent system, and we can approach these through better intelligence in the aircraft itself. We are requiring more extensive flight recorder information. We are looking to more sophisticated data systems aboard the aircraft.

I want to speak just for one thing. It was mentioned earlier that the anonymous reports, I believe one of our colleagues mentioned here, were of little real value to him, or I should say that he did not encourage the anonymous report. I think any information we can get is valuable to put into the system, but somehow you have to protect the individual who reports. We have granted immunity to certain types of information that comes into our hands because we are more interested in the safety results. These are in areas of reporting near midair collisions and in the area of using data recorders for information to lead to safety actions, such as voice recorders and flight recorders. We feel, to give immunity to people from any type of action that would reflect upon them personally would bring about more factual information. It is something that I think should be considered in its view and its light.

I don't want to take up a lot of time randomizing our activities here in Flight Standards of the FAA because the Director will be on this afternoon and I am sure you can get to him a little bit more in some of these areas.

But I do want to leave you with a thought that should, I think, affect all of us in this business and that is we've got to systemize; we've got to get intelligence; we have to rationalize; and then we must act swiftly to try and prevent similar occurrences when we have knowledge of a situation pending. That's where the FAA fits in the role. We can go out immediately when there is a problem; we can take corrective action; we can take the most severe action, though we certainly never want to take this type of action of restricting the operation from the vehicle until the problem is solved. But basically, we try to find a way to live within the system, to keep the system moving, yet moving safely.

With that, I'll respond to any questions that might follow.
Thank you.

SESSION 1

"Aircraft Accident Investigation ...
Organization and Planning"

Paper read by:

DEPUTY CHIEF INSPECTOR OF ACCIDENTS U.K.
MR. W. H. TENCH

Accident Investigation Branch of Department of Trade and Industry is autonomous under Chief Inspector of Accidents. It comprises approximately 25 officers - half pilots (airline or test pilots) and half experienced engineers. All are general practitioners, not specialists. U.S. regulations permit the co-opting of specialists in particular accidents when necessary and these are frequently sought from Government Agencies if possible, to ensure impartiality. RAE Farnborough, National Gas Turbine Establishment, Royal Armaments Research Development Establishment, are typical sources.

A particular accident investigation is the task of a Principal Inspector who is assisted by other Inspectors (pilots) and Investigating Officers (engineers), the numbers being dependent on the size of the problem. The Group System is the basis of the field inquiry and with a four engine jet it may be necessary to invoke the full organization as described in the green pages of Annex 13. With smaller aircraft, like the Viscount, an Investigator-in-Charge might be accompanied by two inspectors whose activities would be concerned with general operational matters on the one hand and witness statements on the other. In addition, the two Investigating Officers would be concerned with airframe and powerplant aspects respectively. In almost all fatal accidents, a consultant aviation pathologist will participate, and when the aircraft is equipped with a flight recorder an Investigating Officer will be concerned with its recovery, readout and the presentation of a corrected graphical or digital representation. The analysis of the flight recording is essentially the job of the Operations Group. In a small air taxi type of General Aircraft accident one Inspector plus one Investigating Officer will look after the entire field inquiry stage.

On receipt of the field inquiry reports, the Principal Inspector conducting the investigation will draft his report then, in accordance with our legal requirements, send copies of the significant points of the draft report to the pilot (if he survived; or his legal representative if he was killed) and the Operator (Carrier). A copy will also be sent to anyone whose reputation is likely to be adversely affected by the report. These people are invited to make representations to the Inspector conducting the investigation who will amend his draft report as he considers to be appropriate. The report is then signed by the Principal Inspector and submitted direct to the Minister by the Chief Inspector of Accidents. At the same time, a copy of this final report is sent to the pilot, the operator and those whose reputations might be affected. If these interested parties are not satisfied that sufficient account has been taken of their representations, an appeals procedure exists by which they may ask for a Review Board to be set up to take a second look at the Inspector's report. The findings of the Review Board are final. The reports are normally published.

We are at the moment preparing a detailed contingency plan for investigating a catastrophic type of accident for the very large wide-bodied jet and SST. These plans designate particular tasks to named individuals in our organization and include participation by Accredited Representatives and their advisors together with representatives of the relevant manufacturing and operating agencies concerned. Incidentally such an event will use almost all our personnel, leaving just enough to hold the fort at H.Q. to deal with remaining matters at hand.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 2

November 2, 2:00 P.M.

"Role of Interested Parties
in Accident Investigation"

Moderator: Jerry Lederer, NASA

Washington, D. C.

SESSION 2

"Role of Interested Parties in Accident Investigation"

MR. JERRY LEDERER, Moderator

The title of this session is "Role of Interested Parties in Accident Investigation." It has been my experience that the most interested party in every accident has been the funeral director or the undertaker. And we don't have him represented here. Somebody mentioned, this morning, an airline buying a lot of caskets. This was actually the case. This airline had an accident in the East, a fatal accident that killed a lot of people - it was a DC-6 - and the undertakers in the entire region got together and cornered the market on caskets and raised the price four or five times the normal price for the caskets. That airline decided this would never happen again so they bought a bunch of caskets and put them in storage in one of their places near the headquarters. One day came time for a press review of the headquarters of this airline and among the places that the press went to look was the storeroom with all these caskets. They quickly got rid of the caskets after that and substituted canvas bags which were not so visible, but there is an actual story behind that casket deal.

The interested parties are not only people who are interested from the point of view of many litigations, although there are more lawyers at these hearings than are technical people, but the accidents reflect on the efficiency of management, reflect on prestige, both company, personal and national, they affect labor management relations. There are many reasons why people are interested in an accident investigation, and I hope these will all be discussed in the next hour or so.

The first speaker is George Wansbeek. It says here the Netherlands - he's with KLM Accident Safety, and I think most of you have heard him before.

MR. G. C. WANSBEEK, KLM

When I considered the invitation to give my views on certain aspects of the participation of an airline in an accident investigation, I realized that the place of our meeting was a complicating factor. For in this country the position of the airline has been very well recognized by the investigating authority. Consequently, during an investigation an airline can present its points of view, thus contributing to a really comprehensive investigation. The United States is not alone in such an attitude (Mr. Tench gave this morning a description of his attractive setup in the U.K., and another good example in Europe is given by Switzerland), but in many countries - including some countries with a real high standard of aviation - the position of the airline and other interested parties during an accident investigation leaves a lot to be desired, to the detriment of the real purpose of the investigation, to wit: to draw lessons which can help in preventing similar occurrences. These countries have not kept up-to-date in the development of the state of the art and it is especially with a view to this situation that the following points of view are presented.

May I add to the above introduction that my remarks on this subject are not made in the name of any airline; my comment is given without any authorization from anybody, though I have consulted several colleagues on this subject.

In a few decades, the work involved in the investigation of an aircraft disaster has developed from something like a one-man-show to a performance of a high grade team. I am convinced that the experts who were assigned to perform such a one-man-show were very fine, able and dedicated people. However, the task to be performed became more and more complicated, and the consequences of the final outcome became much more far reaching and, therefore, trained teams have taken over.

In our daily life it is generally recognized that no unbiased opinion on any controversial occurrence can be reached if all factors have not been considered and if all parties which had their share in the occurrence have not been given ample opportunity to give their views and to explain their action.

An aircraft accident is such a controversial occurrence. Therefore, it is fully in line with the afore-mentioned generally accepted principle that an airline must be given ample opportunity to present and to explain the case from its point of view. Only then can its product be properly judged. I'm speaking from experience. Within my own airline it is one of my tasks to investigate incidents and it has occurred several times to me that I had to change my "sound and firm opinion," once I had listened to the pilot or to another member of the personnel involved. The same applies for policies and procedures of the airline.

This danger of one-sidedness is greater for the official investigator. As a Government official, he will have the strong tendency to merely rely upon his own comparing of facts versus rules. However, it must be constantly realized that a sound operation is not guaranteed if only the rules and regulations are followed to the letter. Before judging a pilot's actions, first listen - if possible - to his explanation of the facts; before criticizing and airline's attitude, first try to understand their relevant philosophy.

This point of view was strongly supported by the airlines, when in early 1965 ICAO reconsidered the contents of Annex 13. The Report of the Session (ICAO Document 8486, ALQ III) contains the following paragraph concerning the Role of the Operator:

"The Attendance of representatives of the operator at an accident investigation was discussed. It was considered that the best technical advice available should be used and that the operator, being fully familiar with the aircraft and the factors associated with its operation, could provide a valuable contribution to accident investigation. This had been amply demonstrated in the past, and experience had shown that operators' representatives had maintained an objective attitude towards the determination of the accident cause. They had normally served in a consultative or advisory capacity rather than as full members of the investigation body and their contribution had been

under the control of the investigating authority. It was noted that the operators' representatives were often able to arrive at the scene of the accident well in advance of the accredited representative of the State of Registry, and were frequently called upon to supply essential facilities and services for the timely and effective initiation of the investigation. It was also believed that their presence early in the fact finding stage could sometimes result in the initiation without delay of remedial measures to prevent further accidents.

"It was agreed that the attendance of representatives of the operator was desirable at an accident investigation so that they make an effective contribution to it and that their attendance should be arranged through the State of Registry. It was considered that a Note would be appropriate to provide for the timely presence of representatives of the operator at an investigation when the State of Registry did not appoint an accredited representative, or when the attendance of such a representative was delayed. As a consequence of the above consideration, the following recommendation was developed: Representatives of the operator should be permitted to attend the investigation in order that they may make an effective contribution to it. The attendance of these representatives should be arranged through the State of Registry.

NOTE: Nothing in the last sentence is intended to preclude the attendance of representatives of the operator when the State of Registry does not appoint an accredited representative or if his arrival is delayed."

The above recommendation can be found in the present edition of Annex 13 under 5.10.

Also in the present edition of Annex 13, the participation of the operator in the Working Groups has been mentioned. In Attachment B, "Organization of an Accident Investigation," under 2.2, the following is said about Working Groups:

"The Investigator-in-Charge should establish Working Groups, as required, to cover various phases of the investigation. Normally, specialists from the State conducting the investigation will head the various Working Groups and the membership of such Groups may consist, as appropriate, of not only specialists from the State authorities concerned, but also the operator involved, the manufacturers of the aircraft, powerplants, and accessories and from the various flight crew representatives and other interested parties who can contribute through their technical experience. "

So, from the quotations from the present Annex 13, it looks as if the Role of the Operator is dealt with in a fully acceptable way. However, two remarks may be appropriate.

1. I have just quoted from the Report of the Third Session a paragraph in which the Role of the Operator was explained. Though the wording chosen is very flattering for the operator and "it was agreed that the attendance of representatives of the operator was desirable at an

accident investigation so that they make an effective contribution to it," the meeting was satisfied when the participation of the operator was described in a recommendation only. Consequently, after an accident, the operator may face a situation in which it has to start negotiations to be admitted as a participant and the answer is uncertain. This is not a very desirable situation.

2. It is by no means certain that the investigator will establish Working Groups, as advocated in Attachment B to Annex 13. Therefore, even if the operator is formally admitted to participate, this is no guarantee that his appraisal will be taken into account. From my own experience, I know that this situation can occur. I am convinced that in these cases the quality of the investigation suffered by lack of proper Working Groups and by lack of sufficient call on the operator's know-how.

These two remarks may indicate that the participation of the operator in many countries leaves a lot to be desired. This is so. It is, however, a requirement of efficiency that the operator's input is given right from the beginning of the investigation and, with due respect to the investigator, it is my firm belief that he generally cannot do without the input, the appraisal and the comments of the airline.

Of course, the possibility exists that the views differ on certain details. This may well be a favourable factor, as the investigator will have to consider all aspects of the problem before formulating his final report. Again, from my own experience, the possibility exists that only the investigator's ideas are aired in the report and during the public hearing, and that other hypotheses and opinions are not even mentioned.

Such an investigation gives a one-sided presentation and this is completely unacceptable in a modern investigation.

In the foregoing I have said that it is only normal after a controversial occurrence as an accident, to listen to the voice of the airline, that it is beneficial for the investigator if the airline can help him right from the beginning as even the best investigator cannot have the expert knowledge of the airline's specialists, and that it is good if differences in views about possible contributing causes to the accident can be reflected during the investigation and in the report. When considering the operator's role, I fully realize there are pros and cons. So far, I have only mentioned pros, but it is honest to name cons as well. The main objection probably is: the airline is an interested party, it is directly interested in the outcome of the investigation. It is of great importance to the airline that its name will remain as undamaged as possible and that the financial consequences will remain as low as possible. Furthermore, the airline is generally "suspected party number one." If we put together all causes and contributing factors of all aircraft accidents, I am pretty sure that the majority of these items have originated from somewhere within the airlines (their procedures, their training, their personnel and so on). In all objectivity, I have to admit that being an interested and suspected party does count against admitting the operator in the team of the investigator.

(By the way, the same objection of being an interested party can be made in those countries where the rulemaking and rule enforcing authority participates in the investigation, or even acts as investigation in charge. However, this point is outside the scope of my subject, which deals with the Role of the Operator.)

Though in my opinion the balance of the afore mentioned pro and con factors is strongly in favor of the operator's participation in the investigation, I wish to add two final considerations.

The first one is, that no one will deny the fact that the investigator must be an independent authority and certainly not an airline official. The operator's representatives must continuously be aware that their duty is to give their appraisal and to do their utmost to unveil the causes - all of them - which brought disaster. This attitude is in the interest of the public and the airline industry at large. I am convinced that the operator's contribution has been and will be in this spirit. In case of an unfavorable exception, it still is the investigator's prerogative to change his team and to expel an unsuitable member. Let there be no doubt on the point that the operator's task is not to prove the innocence of the airline, nor to keep the carrier's name free of blame.

My second consideration is that many airlines have shown in the past that they are honestly and seriously trying to find the cause of irregularities. Many airlines include somewhere in their organization a safety officer, a director of safety, a safety department or such like. Nearly eighty IATA carriers are participating in a safety information exchange system, in which they inform each other on a strictly confidential basis of lessons they have learned which could be beneficial for others as well. Although often an airline is not proud of the facts they submit, this is done in the interest of all. These airlines have proven that they are eager to know their own shortcomings and that they deserve confidence in this respect. I am sure their number will increase. Certainly these operators ought to be allowed to participate in every detail of an investigation.

Mr. Watts and Mr. Yeends, in their presentation, have spoken about the investigation of incidents. I would be eager to discuss possible procedures in this area - I am a strong believer of the fact that the airlines have a great task in this respect. I even believe it is in the general interest to avoid much activity of the governments in this field, but a discussion of this point would be outside my present task. May it suffice to say that in my country the major airline has a very satisfactory cooperation with the authorities with regard to incidents investigation - they get the reports but agreed to take no action at all.

Gentlemen, when I put all the factors about participation of an airline together, I realize that there are considerations which count against admitting an operator as participant in an investigation. However, the pros are much more important and it is my sincere opinion that an investigation is deprived of essential information and assistance if full use is not made of the operator's input.

SESSION 2

"Role of Interested Parties in Accident Investigation"

CAPTAIN EUGENE R. BANNING, ALPA

Thank you, Mr. Chairman, Guests, it is a pleasure to participate in our first SASI Forum.

ALPA desires to participate in the investigation of airline accidents and we have approximately 200 active pilots in our safety organization for this purpose. One of the reasons for this interest is the following fact: From 1956 to 1967, 197 pilots lost their lives in aircraft accidents, as compared to 143 heart and respiratory; 69 cancer; and 39 automobile accidents. Thus, we believe much more progress must be made in the prevention field.

From the viewpoint of the Air Line Pilots Association (and the International Federation of Air Line Pilots Associations) the participation of active pilot members in any investigation is most important. There are many procedures, practices and handling of the airborne equipment, functioning and use of ground facilities - the knowledge about which can be provided by active pilots experienced in the particular operation. We have noted over the years that absence for a short period of time easily causes loss of some of the understanding of operational practices.

It is not the intent to participate solely to endeavor to place blame in any area or to avoid its being placed on the pilot. It is our belief that, in the event the pilot did err in his actions or cause the accident, he certainly did not do so intentionally. Experience shows that there is almost always more than one cause, and of many contributing factors. We would wish to find all these contributing factors, and correct them, so that they cannot combine again to cause further disasters.

We believe that all the contributing factors should be described and shown in the report, so that work may be undertaken to eliminate such causes. Often there are additional points or events which come to light during investigation that have no bearing on the particular mishap. These most certainly should be pointed out and shown in the report in order that they, too, may receive treatment or corrective action in the area to which they pertain. Examples of this are many; such as fire, explosion, malfunction of equipment, inaccuracies in support facilities, etc., where they were not significant to the causal factors.

Investigative authorities would be derelict in their duty if they failed to make note of these in their report of the accident. If at all possible, and we believe it should always be possible, recommendations should be included for improvement in the additional areas as well as in the probable cause.

If we fail to bring out the hazards - all of them - then we have not succeeded in the objective of investigation, i.e., to find out, and correct, the causes of mishaps.

For this reason, all mishaps should be investigated and treated, not just those in which large loss of life or property occur. It is recognized that cost is always hanging over our heads, severely limiting the extent of these total efforts. Who can say that a minor "incident" today may not combine with some coincidental factor tomorrow, with catastrophic result? Or, who can say that clues revealed in a minor mechanical breakdown may not be the missing link in some larger series of investigative effort or research to correct a known hazard.

These are some of our considerations as a participant in investigation. Through IFALPA by way of ICAO recommended practices, pilot organizations throughout the world try to join in investigation of as many accidents or mishaps as are possible. We would urge every country to adopt practices similar to those of the United States in this participation.

The role of other interested parties may vary slightly from the pilots; for example, expertise is needed in many specialized complex areas.

There are some parties who, by the nature of their affiliation and involvement, always will be involved later in possible litigation and financial responsibility. The difficulty posed by this situation is considerable. The investigative authority is not included in this situation, and neither are the pilots, generally. The inhibiting effect of this likelihood places a severe handicap on many people. We earnestly hope that some means can be achieved to eliminate this factor and allow completely unfettered investigation.

There are some other factors which we believe work to the detriment of free investigative effort. These are proprietary interests and information, even governmental responsibility, as well as the desire to appear clear of blame.

We believe the "group concept" as applied here works quite well in the investigative effort. The factual report is prepared with participation by all parties; however, once this is concluded the final composite of the report is not again available for this combination of effort. We believe the final report should be built from a preliminary one which is subject to prior study and evaluation by the parties. Comments regarding this should be supplied and considered before the final accident report. This would not only carry through with the combined effort, but would avoid difficult problems of arranging any lack of concurrence or additional comments after final printing. It is most difficult to obtain a reconsideration of the report, or any part of it, once it is at that stage. The preliminary report review would not be difficult, and while it might not bring out any additional knowledge or consideration sometimes, at other times we believe it would do so.

The press of time should not prevent such a method from being used.

The use of preliminary reports issued by the Board and the issuance of timely information such as "The Anatomy of an Accident," as in the case of a 707 accident in Alaska, is fully endorsed by us. When knowledge is available which may prevent a future mishap it is vital that the industry receive it as early as possible.

I would like to mention just a few particular hazard areas which concern us deeply. The protection of aircraft fuel systems from internal fire and explosion is one. We believe it is within the state of the art now to positively prevent these. We urge the FAA and industry to proceed at once with action to achieve such protection.

The matter of accelerate-stop distances, the V_1 concept, and the wet runway takeoff and landing need re-evaluation. Approach and landing accidents, still the greatest area of accidents, should continue to receive attention and preventive efforts.

The Association remains very concerned that improper usage of recorders is quite likely to decrease their benefits. The intent and purpose for which they are intended is very good; that is, for useful assistance in accident investigation. We strongly support this; however, other uses are not proper or legal. We endorse the remarks made by Mr. Watts this morning on recorder requirements.

We also favor the use of engine parameter recorders if these can be utilized to prevent major deterioration or failures in engines. This type recorder use is not normally connected with accident; rather, it is preventive in nature.

Thank you.

SESSION 2

"Role of Interested Parties in Accident Investigation"

MR. WILLIAM B. BECKER, ATA

When I was first asked by Jerry Lederer to participate in this discussion this afternoon, I was at first somewhat overwhelmed by the size of the 3-day agenda. But looking further I found all the agenda items for your Seminar are linked by two basic well-defined words -- "aircraft" and "accident." There are other words contained in the agenda item titles such as the words "typical" and "unusual," when describing an accident. (By the way, I submit that there is no such thing as a "typical accident" or we wouldn't be here and the whole business would be handled by computers.) Further, as the Seminar itself is titled Aircraft Accident Investigation, I am back to my two words. We have an aircraft and we have an accident; then we have an investigation of that accident. Title 7 of the Federal Aviation Act of 1958 is clear that for aircraft accident investigation -- (i.e., investigation of an accident involving a civil aircraft) -- the statutory responsibility falls on the National Transportation Safety Board. The Board's responsibility is to make rules and regulations governing notification and reporting of accidents involving civil aircraft, to investigate such accidents, and report the facts, conditions, and circumstances relating to each accident and the probable cause thereof. Reports are made, as well as recommendations. Lastly, it is the Board's duty to ascertain what will best tend to reduce or eliminate the possibility of, or recurrence of, accidents. And, here is really where we, the interested parties, come in, because all of us in the aviation industry business have as our primary aim and goal, the reduction or elimination of accidents. It is this role that we will specifically discuss briefly this afternoon. How can we, all of us, with our particular expertise and knowledge peculiar to our own area of operations assist the NTSB in attaining our mutual goal?

As to my part of this discussion, I will briefly touch on the role of the airlines and ATA. You recognize that ATA's role is of a supporting nature to our 32 member certificated scheduled airlines. Only when requested by the airline involved would we actively participate in all phases of the accident investigation. We have actively participated as a party to the investigation in a number of accidents over the years. On the other hand, we work closely with our airline members, and assist wherever possible in every airline accident investigation. The Board's regulations state that an interested party, or parties, to the investigation of an accident are "those persons, Government agencies, companies, and associations whose employees, functions, activities, or products were involved in the accident, or who participated in the accident investigation and whose special knowledge and aeronautical skills contribute to the development of pertinent evidence." And let me interpose right here a quick point. We believe that participation in the actual accident investigation in the field - at the scene - should be essential to the designation as an interested party for any phase of the investigation. Participation in the field accident investigation phase should be a requirement in order to permit any agency, company, or association to participate in the hearing phase of the investigation.

In any accident involving airline aircraft, the airline automatically becomes a party to the investigation - being the operator of the aircraft. Regardless of the degree of seriousness of an incident involving an airline aircraft, if the definition of an accident is met, the airline is involved. Going up the scale of seriousness, in most cases, another automatic party would be the pilot fraternity. The airline's role begins upon notification of the fact that the accident has occurred, and continues in detail until the matter is closed by the NTSB or for that matter, let's face it, many times way beyond that time frame. The degree of participation and the amount of effort expended, of course, will depend on the seriousness of the accident. In a catastrophic accident, with full-scale field investigation, airline personnel are involved in all aspects of the investigation and are on each of the various teams formed to obtain factual data as to what occurred. In addition, great quantities of data are obtained from the operator, such as the aircraft and pilot records, load manifests, dispatch records, etc., from the airline's home base.

The field investigation, particularly of a major accident, is as we have briefly touched upon, just one phase of the total accident inquiry process. And the word "inquiry" is defined as "The process leading to a determination of the cause of an aircraft accident, including completion of the relevant report." Thus, the field investigation is but one element in the overall fact finding process. Another and very important element from the public's standpoint is the aircraft accident hearing. Hearings are not held in the case of all accidents, even involving airlines, and indeed need not be. But where such are held, particularly in the case of a catastrophic accident, the procedures and requirements concerning the conduct of such hearing have been more formally set forth than the field investigation phase. Rules of practice for aircraft accident investigation hearings are set forth in the NTSB Regulations. These regulations define the nature of an accident investigation hearing as a fact-finding procedure with no formal pleadings or issues and no adverse parties. Since the accident hearing is simply one of the elements that goes into making a complete inquiry into an aircraft accident, its objective, (as we believe is the objective for the field investigation phase), is to discover the facts, determine the cause and ascertain the corrective measures to prevent similar accidents in the future. Accident investigation hearings are not for the purpose of determining rights and liabilities. Since the beginning of aircraft accident hearings in 1934, the airlines have concurred with this objective, and with the nature of accident investigation hearings conducted initially by the Civil Aeronautics Board, and now by the NTSB.

Up to 1957, all questions of witnesses and parties at an accident investigation hearing were asked by the presiding officer or other members of the Board of Inquiry. Other persons present could submit questions to the presiding officer and witnesses would be queried if the presiding officer found such questions proper and relevant to the proceeding. In 1957, however, the rules were revised to provide for certain "designated parties to the investigation" to participate in the accident investigation hearings, with spokesmen having the opportunity to question witnesses following questioning by the Board. "Parties to the investigation" are those who are in a position to contribute to the accident investigation specific factual information, or skills, which would not otherwise be supplied. Initially, and repeatedly, claimants' attorneys have been

denied the opportunity to become a party to the investigation. The Board's ruling on this matter has been that it never was the intent to open up such hearings to an adversary proceeding. In this, the airlines strongly concur.

The accident investigation responsibility was transferred from CAB to the NTSB in 1967. However, no major modifications have been made to the rules for the conduct of aircraft accident hearings. Though the present procedures may be said to be a product of compromise, the airlines support the existing rules and seek no major change. Though the airlines are concerned with occasional misuse of the press coverage and the occasional tendency for the hearings to become enmeshed in legalistic overtones, the present rules, when properly applied, adequately serve the purpose for aircraft accident investigation hearings.

As stated previously, the airlines are opposed to any adversary type of proceeding. Not only is an adversary type of proceeding unduly complex and lengthy, but the goal of accident prevention and thus "safety" would be lost in the effort to establish "fault" in a legalistic sense. We believe such a procedure would deter the revelation of certain facts necessary to determine the cause of an aircraft accident and ascertain proper corrective measures. Every witness would be on the defensive - many facts could not, and would not come forth. Again, as in the field investigation phase, the role of the airlines, as well as ourselves, where ATA is involved, is to supply our expertise and knowledge for the full disclosure of the facts of the accident, so as to effectively and equitably lead to the reduction or elimination of accidents.

In conclusion, in this statement I have emphasized but three points which I hope each of you would note. They are:

1. To become a participant in the hearing phase of accident investigations, the party must also participate in the field investigation at the accident and be designated as an interested party in that early phase of the inquiry.
2. There is no room in an aircraft accident investigation for participation by claimants' attorneys or their clients.
3. An adversary type of accident investigation hearing is inappropriate - it would take far too much time, and the results would be less effective in determining the probable cause.

SESSION 2

"Role of Interested Parties in Accident Investigation"

MR. ROYS JONES, AOPA

You know, apropos of nothing at all, sitting here listening to Bill Becker, who has been my friend and corporate enemy for many, many years, he being the airlines and I being general aviation, at least for five, it struck me very forcefully that regardless of where we sit and how we stand, we're pretty much thinking alike in terms of accident investigation and what we want to get from it, because Bill said many things that are very germane to our operations also. And he said them very well. And aren't you surprised?

It's been truthfully said that the pilot is usually the first one to arrive at the scene of an accident, and this is closely followed by the investigating team. And, if the accident involves an air carrier and a general aviation aircraft or if it involves a general aviation aircraft in a serious accident wherein air traffic control, for example, is also involved, AOPA asks the Board to become an interested member of that investigating team. And we appear as early as possible at the scene of the accident to participate in the organization meetings and on the Accident Investigating Team. Now, the reason for this, I think, is pretty obvious. Our only goal is to try to get the facts of the case represented as truly and honestly as possible. I said that this morning, and I repeat it here for emphasis. My role on the Accident Investigation Team starts out as the general aviation or AOPA coordinator. This means that I try to act as an advisor to the owner or operator of the airplane, if it happens to be company owned, like a fixed base operator, or as in general aviation if the owner of the airplane happens to be killed in the accident itself, which happened out at Riverside, California, a year or so ago.

As a member of the ATC group, we participate in transcripts of the radio-telephone and interphone conversations. But one of our most important duties is to fix the exact time of everything; and as Bob Rudich here knows, this is a hell of a job. To correlate a dozen tapes, some of which may have a time hack on them - some of which may not - and come down to the actual time of the accident within plus or minus a second or two. And it's remarkable how often this is achieved. It's relatively important, but I can give the insurance people a case where it would be extremely important as to whether the accident happened at 11:59.59 at night or 00:00.1 in the morning. Because, as I understand, many insurance policies cease to exist at midnight.

Now in participating in the accident, we also participate in the development of investigation of the facts in the case and the preparation of the ATC and Operation Groups' factual reports. Usually on the team is the Operations Group, which takes a look at the wreck and tries to find out what failed - or the Structures Group. The general aviation representative is usually the fixed base operator or his representative or the mechanic. In the case where the owner has expired with the accident, we try to obtain the services of a knowledgeable pilot or mechanic in the area to participate on that particular group. This does not happen very often, but it did in one particular case that I know of.

Another item that concerns us - and I couldn't agree with Bill Becker more - is doing what we can to keep the press from having a Roman holiday simply because of the accident. Unfortunately, and I notice that George Haddaway is going to talk about this a little bit more - and this is the third hat he's wearing today - and I hope some of this stuff comes out with the very valuable assistance of Bob Serling - the press immediately (the fire hasn't even died down and the smoke hasn't cleared from the wreckage yet) comes out with scare headlines that "some little general aviation airplane has rammed an airliner and killed a lot of people." Regardless of the facts. The only place I know of that this didn't happen was the midair collision over New York and the one over the Grand Canyon where there were no general aviation airplanes within miles. But I think, if I recall, even at the Grand Canyon there was a suspicion voiced in some reporter's article on that wreck which said possibly a third aircraft was seen. Now, I don't know who the hell saw it, because nobody saw the midair collision from the ground.

But at Milwaukee, for example, there were scare headlines in the paper that "Hero captain lands crippled airliner," and in the body of that newspaper item was that the little airplane rammed into the airliner. It sure did. There were parts of the tail assembly ingested in the right engine of the airliner and the entire cockpit was embedded in the right hand side of the airliner facing the same way the airliner was facing. Now it's very difficult for a Cessna 150 to run into an airliner, tail first, when the difference in speed is over 100 knots. But we are faced with this constantly and the only thing we can try to do is help the Board and help everybody else to try to present the true facts.

Another role we play is to provide such technical assistance and expertise as may be appropriate, both at the investigation and at the public hearings, if public hearings are held. This technical assistance is available to the operator or owner of the airplane, and is also there to try to bring out the true facts of the case as far as general aviation is concerned.

I have one other thing to say and that is to endorse very heartily the comments of my 25,000 hour pilot friend on the right in asking the Board to enable the interested parties to review and comment on the entire report before it is published.

As a member of the Accident Investigation Team participating in the ATC Group, on that team I am privileged to review the factual report of the team or the group chairman before it becomes a part of the report. But we never see anything else that gets on that report, including the findings, the probable cause, or some of the extraneous remarks that are contained in that report.

I think if the interested parties, in full confidence of the Board, are permitted this privilege, that the quality of some of these reports would be increased significantly.

Thank you.

SESSION 2

"Role of Interested Parties
in Accident Investigation"

MR. JAMES F. RUDOLPH, FAA

Since I believe all of us here are aware of the Government's position in accident investigation and our responsibilities, particularly in the U.S., I'm going to skip what the FAA role is and I'm going to capture about five minutes and bring you up-to-date on three very important programs: Wake Turbulence Tests, Project 85, and Area Navigation. I appreciate, Roys, that this is a departure, perhaps, for the FAA; but I think this is an opportune time for me to bring these people up-to-date.

Wake turbulence was started December over a year ago, and we found out a little bit of what was taking place behind a C5A with a F104 and a Cessna 310. In that program at Edwards Boeing Aircraft Company in Seattle, which took place at Everett and over in the desert area and at the AEC tower 15 miles west of Idaho Falls in Arco, we came out with some new separation standards. We called them tentative at that time. Following that, we came up with a follow-on program at Edwards Air Force Base where we used a C5A again, a Convair 990 with highly instrumented aircraft following the original tests at Edwards; this time we were looking at the lighter aircraft - the DC-9, Lear Jet, Cessna 310. Also in that follow-on program at NAFEC, we used a 140-foot tower to verify what we found out at Arco, at which AEC asked us to more rightly refer to the AEC Center at Idaho Falls. In this tower test at NAFEC, we verified what we learned at the Idaho test; and in addition, what was happening to the wake in ground effect. Because here we used glide slopes to .75 degrees and we hit the tower at 100, 80, 60, 40, and 20 feet to a landing, so we had visually and also on recordings what the wake was doing. It was here that we learned a lot. We learned that the wake does not behave as some of us thought. In fact, it will actually loop over, as a rope would the tower, and completely by-pass the tower. We found that when the wake hit ground effect, it did not, in fact, wash itself out but became appreciably disturbed. We also found the 727 and DC-9 wakes were tighter and that the core was smaller than we had forecast. We found out there that the cores of the other jets were almost as we had forecast. Resulting from that, we now have a new film out on wake turbulence. I had the privilege, of course, of looking at it several times, making sure that technically we had it as near perfect as we knew how with technology of today. Tomorrow, technology changes. In 1959, the British told us a lot about the wake. We have now found a lot more and have added to that knowledge, and this movie will portray to you our latest thinking, at least here in the Government. You should see this movie. It will be available, starting in about ten days, from the film laboratory at Oklahoma City. It is not one that is startling to you, but it shows you pictorially and in real life what the wake looks like. It will show you what the wake does and then through graphics, we have portrayed what the wake does in ground effect with a little bit of wind; and through that, we now have come up with a new Advisory Circular that should be out in about 30 days. Printing is our biggest problem area in getting it to you. Anyway, do take a look at this new film on wake turbulence. It's up-to-date and the newest in the way of the information available to us.

Area navigation has been with us for a long time. If you want to consider that those of us who took out for "that-a-way" on our own, but now are doing it with new technology, we are able to at least retain the accuracy of the present navigation system as we know and do area navigation. Very quickly, there are any number of area navigation systems being offered on the market today and I'll name three. These are not the only ones; they are representative. There are the Butler-Vac System, the Decca-Omni Trac System, and the INS Systems with updates. All of these carry with them the capability of the accuracies of the systems we know now, using their systems as they were designed. Some of the benefits of area navigation: it's a by-pass, it's a dual route, it will lead you around congested areas, it has the capability of offering to the pilot and to the controller being able to navigate on those routes generally flown and generally used and related to us as radar vector paths. Area navigation is not as fast coming along as some of us would like to see it. I am particularly one that is a little bit short on time, and always have been. Don Kemp will tell you that my expressions are one that don't lead to six months or even a year's development time; I'd like to see it today. I certainly want to see it tomorrow. But anyway, those of you who are not familiar with area navigation, please look up Advisory Circular 90-45 and its concepts.

Project 85, Dick Sliff told me as we passed just before I left the Headquarters that it is of considerable interest here. Project 85 is the FAA's Accident Prevention Program. It completed its two-year test program June 30 of this year in the Central and Southwest Regions. We set it up as a two-year program; and now the Administrator has signed the order establishing the programs in the rest of the regions except the European.

The objectives of this program are quite simple. (1) To achieve improved aviation safety through application of effective accident prevention methods and techniques; and (2) to motivate the entire aviation community through the increased leadership and participation in safety activities and to increase the personal involvement of all airmen. This is accident prevention as we know it, as we're proceeding with it. We will have one specialist in each GADO (General Aviation District Office), we will have one coordinator in each of the regional offices.

Thank you.

SESSION 2

"Role of Interested Parties in Accident Investigation"

MR. GEORGE HADDAWAY, Flight Magazine

The method in this is that we're not going to spill over into my session which comes up at 3:30. We're going to have a little break here to get a martini or some coffee. That's why I'm here. It's to get the hell out of here for a few minutes. But first, I want to announce that 72% of you failed my quiz at lunch. I'd also like to say for Bob Cronin and myself, we want to invite this group to Texas for next year's seminar and forum, and we guarantee to get you some sponsored events to cut the cost down so you won't be beholden to the sponsors. Also, we'd like to try, by such a forum down home, to fatten the coffers of the Society so it can continue its rapid rate of growth. This is an official invitation, Mr. Lederer.

Third, I'm glad that Rudolph mentioned area navigation. There are some very shaking things coming along. The warning I want to give before I turn this over for adjournment because of the next panel session - anything I'd say would be redundant - is to warn you, probably about what you already know, and it's going to affect accident investigation, it's going to affect NTSB, it's going to affect the FAA. This nation is slipping in every phase of aero space, aviation in space. It will keep going down the road we've been going down the next year. We'll probably be a second or third-rate nation in these two areas. Even the pork barrel is empty in this country. We can't even scrape the barrel and get anything out of the pork barrel. Which means that your budgets are going to be cut. Money is going to be hard to come by, no matter who wins the Tuesday's elections. I think Roys Jones will be the first up here on this panel to agree with me that the aviation trade press is one of your best friends. And we should be in a little bit better position than the trade press in this nation than just receiving your publicity handouts. We're your partner. You are in for a hard year or two coming up, and there's going to be a hell of a lot of work to do, and you'd better get organized for some political action. Even today, there are bills in the Congress of the United States to steal the trust fund money that is coming from user charges. This is how serious it's getting and it's going to take a total aviation landslide to stop the trends going on in the country today.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 3

November 2, 3:30 P.M.

"Accident Investigator's Role ---
Public Relations and the Press"

Moderator: George Haddaway, Flight Magazine

Washington, D. C.

SESSION 3

"Accident Investigator's Role --- Public Relations and the Press"

MR. GEORGE HADDAWAY, Moderator

If there ever was a panel packed with pros, we have them up here at this table this afternoon. A couple hundred years of aviation and writing experience at this table. "The Role of Interested Parties" - this really should be a "slop" over from the previous session because public relations and the press certainly, as far as numbers of people are concerned, is the role of interested parties - that is the public.

All of us at the head table, without exception, have been in this business at least 20 and more years; and the first one, I'm not going to ask him to rise, I'm going to ask him to use the table mike - is a man known ever since Roosevelt was president. He is true public servant. He has a newspaper background. He came out of dear old Boston, the land of the cod. He's been with the old Civil Aeronautics Board ever since it was set up in the Act of 1938 and when they had the old independent Air Safety Board with General Tom Hardin. But he came in about that time and has been ever since in this area and now with the National Transportation Safety Board but formerly most of his years were spent with the Civil Aeronautics Board - Ed Slattery.

MR. EDWARD SLATTERY, NTSB

I am told I am supposed to take the position of the Government in public information and we're also in aviation, so it's a joint endeavor. I'd like you to know one thing about public information. It was first thought necessary when the founders of the country put it into the Constitution and guaranteed a free press. In a small government, there was never much need to worry about how the news was going to get out. But as the government became larger, the need was very real and it eventually developed so that federal agencies in a big government have information offices that help the public understand what is happening and what their government is doing.

Now, when I first went with the Civil Aeronautics Board, the Civil Aeronautics Act under which we operated made it mandatory that we made public our accident reports and that we hold public hearings. And it seemed that was pretty clear and all I would have to do would be to sit there and let it operate. I remember that in my first participation in an investigation on the scene, I encountered something quite different. I encountered the Civil Aeronautics Board investigator in charge who had just removed a camera from a newsman without the slightest bit of authority; except he ruled that this type of information was not for public consumption. Well, I didn't do anything at the moment, and when I got back to Washington, I started to try and put into rules and regulations what was public at an accident investigation.

As George Haddaway said earlier, the public information function of government and the news media is to let the people of the country know what is happening because they can't be there themselves at the time. In a democracy, that's basic. So, from that time on, we permitted photographs of any type at the scene of an accident so long as the photographer didn't touch anything on the ground in lieu of wreckage which might be clues in the accident.

We moved ahead into our public hearings through the years; in my first hearing there was not a press table, because they thought it was just as well for the press to sit out in the audience and make their notes as best they could and get out as fast as they could. Well, we changed that. We put a press table in and gave them pencils, at one time, and hoped that by giving them copies of the prepared testimony, they would get stories more accurately than had been the practice.

The problem of photography came up in the hearing room. Both still and movie photographers wanted a chance to cover a photo news story and later the TV newsman wanted his chance to cover.

Now, these are still news media. They're in a different form. But they're news media and what we were doing was public. We were conducting a public hearing, and I was somewhat amazed to find when I took the proposals before the Board to allow still photography and TV coverage as other expressions of news gathering, that I met violent opposition, not only from outside the Board, but from those interested parties who did not want to see an accident hearing publicized too much, for obvious reasons. Most of them didn't want it reported at all. But in the case of the Board, I found that many of our own investigators and our own General Counsel disagreed with coverage by camera and TV on the grounds that it wasn't done in a Civil Court. Well, of course we're not a Civil Court. We're a fact finding inquiry board, run on a highly informal basis, open to the public in every aspect of what we do. And it seems now that we've reached that sophisticated point in public information where we pick up the morning paper and read that "Ford has just withdrawn 20,000 Pintos, brand new model car, to fix the gas pedals," and gives the serial numbers of the cars, then we can live with the fact that you're going to continue to have public information coverage of especially your major catastrophic accidents in this country. And for another reason, because the Board decides it's good policy. Because back in the year that the Transportation Act formed the National Transportation Safety Board, Congress passed another act, the Public Information Act of 1966. If you study that Act and apply it to our work in aircraft accident investigation and aircraft accident public hearings, you will realize that whether or not it's considered good for the industry to have coverage of a hearing, it's part of the public fabric of this country today in the modern news media that these things be reported. If you ran a hearing as a star chamber proceeding or as a hearing closed to the press or one that only newspaper men alone could report, it wouldn't stand up. You just couldn't do it. And so, I think that it's better to go to the other side and try and make it easy for the news media to get as much information as they can and to try and get to them in an accurate form. At a public hearing today, I have copies of every group captain's report that goes into record so that they no longer have to take what they think the witness is saying; they can take it right from the report after it's sworn in evidence.

In bringing this a little more up-to-date, I mention the Public Information Act, but in the National Transportation Safety Board, the philosophy underlying our approach to public information is a very simple one. It was propounded by a former great chairman of the Civil Aeronautics Board and the first Chairman of the Safety Board, Joseph J. O'Connell. He said that our agency is a public agency. We are paid by public funds. We're engaged in the public welfare and

everything we do is public. Now that is the philosophy and policy behind the business of trying to get the information to the public about what this Board does. It isn't nice in an accident to have to talk about it or write about it or portray it, but it's a happening of everyday life, and as such, it will be reported.

And I think of one other item before closing. One of the functions we have in this new Safety Board is the requirement under the Act that we report and make public all our special studies and all our safety recommendations. This wasn't true under the Civil Aeronautics Board. The safety recommendations were frequently varied in an accident report or referred to in a speech a year later. Now we make them public, as in the case of the 747 engine problems. And there will be those that shudder a little at the frankness of some of these things, but like the Ford Motor Company with its Pinto, like General Motors and Chrysler who found out that when you face the problem directly and tell the public that you are correcting it, they are with you, not against you. And you do not make them afraid to drive any more than we have made them afraid to fly.

SESSION 3

"Accident Investigator's Role --- Public Relations and the Press"

MR. J. HANNIFIN, ASWA

There are some problems of definition where the press is concerned in the realm of accuracy which the gentlemen who investigate aviation safety and aviation accidents -- crash detectives my editors call them -- and we share on a common basis. It goes into numbers; it goes into definitions, and for numbers I offer that the 71 is a 69 watched by two other people. I'll cite for a definition the marriage of two hippies where the judge over here in Virginia looked down on these two youngsters and one was as hairy as the other. Amazingly enough, he couldn't decide which was which - which was the boy and which was the girl. So, and again in pursuit of identification and clarity, he said, "Well, which one of you has the menstrual cycle?" And one of them held up his hand and said, "I don't have a menstrual cycle, I've got a Honda."

I go to the realm of the serious and right away I want to cite the distinguished speech by my old colleague and personal friend, Robert Serling. Many of you who are here in this room heard his speech the other night. He raised like a yellow light the new breed of reporters. We have them. And there is your peril, Mr. Holstine. And also your opportunity. They are better educated than most of us. They are about 15 or 20 years younger and maybe younger than that. They're terribly bright; they're alert; they're inquisitive; they've been taught in new journalism schools to prod, prod, prod. And there's a motive that goes with this. Now, there's an award called the byline. And they shoot for the byline. And they dig around for the exclusive investigative answer. By my definition as an older hand in this trade of report, any kind of reporting is investigative reporting, except my bureau and other bureaus here in town who have investigative reports and their bag, as they call it, is to do nothing but investigate. And it's marvelous. They produce two or three stories a year. But they are diggers. Now, they don't always come with a kind of technical purpose. Not a single one of the so-called investigative reporters here in this town that I know of, for example, has even a private ticket or is trying to learn to fly. Now, you're going to be confronted with these young men and we've seen them in action here fairly recently and I raise specifically the problem of the JT9 engine. I'd like to talk about that in a moment.

The T.V. version of this new breed of reporters tends to be an actor, not a reporter. He tends to get on screen and to act, and he has a flair for the dramatic. And I say in sadness that sometimes a certain emotional prejudice boils down to anti-technology. They're anti-SST. There's nothing that Bill McGruder and a thousand saints can do to change the minds of these young men. I've seen them in action most recently at the Sierra Club Press Conference in San Francisco about a month ago. Bill McGruder was superb. Totally responsive in the technology, totally responsive in the philosophy. I give you one example and you can judge for yourself.

One of the young men who was on camera with his cameramen cranking out 16 or 32 frames a second -- and was like the prosecutor -- and he said, "Mr. McGruder, how many particulate residuals rest behind that SST on a trans-continental flight?" And Bill, who is an extremely calm fellow, very coolly said, "Well, as a matter of fact, the residual, the particulates of the SST,

the engine which we envision to be hung in that airplane, will be about the equivalent of a Volkswagon across country." It didn't mean a thing to those youngsters and it was dropped from their skit. And here was a very vital point and one done with a great figure of speech. The point is that there is an emotional prejudice and this is where the peril is. Where the opportunity rests in sending every one of them to the aviation space writers where they can get a copy fo Bob Serling's book, on newsmen and air accidents and forcing him to read it. I've had a success in my office. Two young investigative reporters have sworn to me that they have read his book. They've read his book, "The President's Plane is Missing." "But, My God," they said, "did he also do that thing on air safety accidents?" And he did.

Also, and in the greatest sense of honoring someone, we of the reporting generation you see here at this table, everyone of us has come under ages and have been shaped and formed in one way or another by Edward Slattery. I've known him 20 years, I guess, from his time in the C.A.B. and in various offices around C.A.B., including the one behind the filing cabinet, to where he is now. And he has left an extraordinary influence. I think Bob Serling would recognize this, Vern Holton, George Haddaway, we all know the influence of Ed Slattery. And when he says -- and I use the term he just mentioned -- the public coverage, public opinion coverage, this is the new phenomenon and the great new media, which is really just beginning to grow up to its responsibility, is television. These very young men with all their prejudices, with all their emotions, with all their incompetence from a technical standpoint, but with that great desire to perform on TV, to scoop the other guy, to become the actor, be the hero, you are going to have to deal with him.

I'm going to send these two kids up to Ed Slattery and I'm going to say, "Ed, for heaven's sake, spend some time with these young people," because Ed thinks as they do. Communicate, get it out. Get it out straight. I can remember a young reporter who was told about the basic pattern in takeoff, downwind, base and final by Mr. Slattery some long years ago. And the young man came back to me and said, "Who's this man Slattery?" Well, we have seen Ed, and I want to honor him here and now.

Now, here's the area in this extraordinary, expanding technology. And again, does a reporter come equipped, for all his PhD's, to report this? No, he doesn't. They don't have a memory for specialization. We'd be very lucky if we had a few more youngsters who felt strongly enough motivated, since they'll be covering aviation, to learn to fly. This means he's got to keep up with NOTAMs and he's got to learn the facts. He's got to learn to read an air chart. And then Ed Slattery doesn't have to say, "Well, now it takes off and goes down wind and crosses in base and then goes on final." And he doesn't have to explain the difference between an omni and a radio beacon, a low frequency beacon.

Now, your best approach, if I dare to make a single recommendation, please be patient with these young men. They're brighter than any one of us, and maybe one of them one of these days will learn to fly and it will be easier to talk to him. But keep in mind also that they'll kill you in that effort to get on TV.

We are fortunate, here in Washington, as reporters, in a very effective communication. And again, I start right with the priority of Edward J. Slattery of NTSB, and his vast knowledge -- and if any one of you wants to test his

memory, I bet he could give you the probable cause of the Fort Leonard D. Wood piston 240 Convair crash of 25 or 23 years ago. This is the realm of the Bobbie Allens, the Mel Goughs, the Marty Clarks, the Chuck Millers. All of you who are here in town. And you do public service. You come to our aviation writers at the Aero Club and you speak to it. And you are available when we need to know within the perimeters. It's like a C.A.B. case underway. You are bound by a search - you're the crash detectives. You, as crash detectives, have to make very, very sure -- remember the definition between 71 and 69 before you proceed. Don't worry about the professionals. I think, although we can get lax and dull and can become too over-specialized, but worry about the amateurs. Take patience with them, as Ed Slattery, who has bred a generation of us.

Now on the current scene, a couple of comments. Consider the handling of the Golden Eagle aviation crash in which the Wichita team, which I'm glad to see is continuing to play, was lost. There have been yards and yards of suddenly acquired expertise on this, and I will make the comment that I thought I detected among some of the new investigative reporters an effort to create, in effect, a clash between the "pesty little government agency, the NTSB, and the mighty FAA." Well, this is a distortion. But this is how these new reporters think, and there is the peril of these new reporters. I'm sure that by the time Ed gets through talking to them, and they get a little seasoning, I guess is the word, they won't be referring to NTSB as a "pesty little government agency" in conflict or at loggerheads with the FAA. It is an extraordinarily powerful arm of this government, in effect, representing the public interest in the cold pursuit of facts and the probable cause in the benefit of us all, and as Ed Slattery has said, it is a public opinion investigation and we will have more of it. But they need an editor sometimes.

I'll raise the issue of a very great engine. An example which sits over there in that glass case in the corner, the Pratt & Whitney Division of United Aircraft's JT-9D. It is an advanced technology engine and with a little luck we may have a story in Time magazine very soon in which we try to go at this on the basis of advanced technology and its problems. Not only in the JT-9, but in the CF-6 and in the RB-211. These are engines which are moving moving forward, cutting the edge of a whole new era, hotter temperatures, different specific fuel, better specific fuel consumption, larger fan ratios, the RB-211 and the three-axis engine. I guess they've gone back to the Titanium for the fans, but this is all advanced technology, and I persuaded my editors, I think, gentlemen, if I am in error, let me know, but I persuaded them that the story is not simply to list 1, 2, 3, 4, 5 ingestions, two or three of the hot-throat turbine explosions, but to consider the problems of advancing technology. I keep reminding that this engine, this aircraft, the 747, which Jeeb Halaby has referred to as a magic magnet drawing people. I keep telling him that this airplane is actually ahead of Lloyd's of London by far. It is now their seventh or eighth month of operation and they transported, like four million passengers and X billion passenger miles and nobody got a stubbed toe. There have been a few hot seats going down those emergency chutes, but Oscar Baake, who I think is known to everyone here, undertook to ventilate the JT-9D, he stood up like he was before one of Fidel Castro's padrones over there in the FAA about a month ago and Oscar took on everybody. I was amazed, however, that one of my senior colleagues, the man is a multi-engine rated pilot, thousands of hours, for a leading West Coast daily, but pushed by the atmosphere

in that particular journal which has toured the super-scoop and for the sensational angle - this man descended on Oscar like a gung-ho trooper from Fort Campbell in full parachute, and he said, "Oscar, I want to know why we can't see the daily mechanicals on that ship. All of them." And he started to make his lecture hopping from one foot to the other and Oscar stopped him in midstream. He shut down the power. He said, "You're not going to see those daily mechanicals. We get these on the basis of trust and that's the only way we get them. And you are not going to open them up to the press on a daily basis." Now, it just happened that Eric Brammer of American Aviation and I, a couple of weeks previous to Oscar's public performance, had gone calling on Jim Rudolph and this was duly reported in my magazine as it was in Eric's. It was in August. And Jim sat down and for two and half hours, til we all cut out to an Aero Club meeting, went over every single problem in that engine on the public ground and on beyond with some interpretation. This is at the time of the ingestions, and I offer that my colleague who is a brave backee, could have done the same thing. As a matter of fact, if we do it the next time, we'll invite him along to save Oscar the trouble in public the next time around.

I'll close by reminding you of Captain Eddie Rickenbacker's great phrase, "In the course of human movement, somebody occasionally stubs his toe, but when they do and whether it's a tiny plane or one of the giant new systems, they go down." Really, it's baiting it to say I'm going to remind you of your responsibility because the accident investigator is a very special man and devoted as you in the public service. I know. I've gone through their heart attacks and all the rest. I am reminding you now it's reiterating that when the new reporter comes around, one, please make sure that he's read the Serling booklet. He'll qualify himself. He's going to tell you I don't have time to read it; I need to know now. All right, and under those pressures within the perimeters of what you can say to him, by all means, say to him, to keep in mind, too, and that goes for me, that it can be occasionally misinterpreted by the well-meaning, but unskilled or ill-informed, and it winds up occasionally with \$2 million successful suits like the one that John Kinley brough against Northwestern-Boeing several years ago in the case of the 707, the 720-B that went down in the Everglades.

I will now close and say again referring to Bob Serling and his first book on the probable cause, and one of the reviewers mentioned at that time that Mr. Serling has a gift for emphasizing the positive about the negative and there is our role and mission with reporters. But watch out for those artists who are after the negative about the negative.

Thank you.

SESSION 3

"Accident Investigator's Role --- Public Relations and the Press"

MR. ROBERT SERLING, Author

Thanks, George and Jerry. Thank you, George, for mentioning my brother, Rod. He's so famous he has an unlisted zip code. And I'm not going to thank Jerry Hannifin. He just took my whole talk away, because actually about all I could say up here this afternoon was that I agree with Jerry, and I'm glad one of my colleagues had the guts to criticize our profession. I'm sort of out of it now, but I was with a wire service for almost 30 years and I echo Jerry's concern and I echo his criticism of the new breed of reporters. God knows, we don't have enough Jerry Hannifin's or George Haddaway's or Vern Holman's. You do have a bunch of wet behind the ears anti-establishment kids coming along and I do not share Jerry's optimism that they can be taught, that they can be educated, because I think when Vern and Jerry and I were learning how to be newspapermen, learning how to be reporters, I think the one thing that was driven into our heads and inserted into our navels and rammed up our butts, was that tiny little word 'objectivity', or to use the synonym, 'fairness' or 'fair play'. I think that this is the one thing that you really can't teach this new breed. I'll go a little bit beyond what Jerry said, and say that it is more than just a new breed of reporters; I think it's their editors and publishers who allow them the kind of license they do. You've got a perfect example in Washington, the Washington Post, which to me has violated every precept of honest journalism, by allowing the editorial policy to creep out onto their news pages. This was verboten when I was a young reporter. I was taught that a newspaper limited its editorial policy remarks to the editorial page and let the news columns speak for themselves. I don't think this is true anymore because what the press can do now is, by omission, they can let their editorial news policy show in their news pages. By their very selection of copy, they can do this. By the fact that they report a story contrary to their editorial policy back in the want ads. This is just as insidious as the new breed of reporter that's doing the reporting and the writing. I don't have any pat answers, no solutions, no panacea for what I think is a very dangerous trend in American journalism. It is certainly a dangerous trend in modern aviation. It hurts me that we no longer have specialists covering modern aviation and that is in direct proportion as aviation gets more complex, as it plays a more vital role in American life and in world life, to have fewer and fewer qualified reporters telling the public about what's happening. Many newspapers in the United States have dropped their aviation editors, their aviation specialists, and I know the very fine able reporter who succeeded me at United Press when I was Aviation Editor, that's all I had to worry about, was covering aviation, with an occasional foray out every Sunday when the Redskins played at home. Now my successor at UPI is covering about five or six other beats. I think this is a very dangerous trend, a serious trend, and a very unhappy and unfortunate trend, because to me it implies a lack of recognition on the part of the bosses, the manager and the management in modern journalism who recognize the importance of modern aviation to our life. The aviation space industry, for example, is about the second largest employer in the United States, but you wouldn't think that. You wouldn't know that to read the kind of coverage modern aviation gets. Since I left UP, for example, if it hadn't been for Aviation Daily, I wouldn't have known what the hell was going on in the world of aviation because I sure can't find it in the Washington Post or in many of the other publications.

We no longer are the only qualified. With a few exceptions, like Vern and Jerry, the only qualified specialists in aviation reporting today are with trade press and, unfortunately, the trade press does not have the general public circulation where it can do some good. I have to disagree with my old friend and teacher, Ed Slattery. At the risk of sounding anti-democratic, I deplore opening accident hearings up to the press until the press can prove themselves responsible and knowledgeable about covering them. You don't have members of aviation space writers covering accident hearings. You get the new breed, or at best, an inexperienced, unknowledgeable reporter who doesn't know the front-end of an airplane from the rear. There is an evil in closing these hearings to the press, but don't we have an even greater evil when public hearings are distorted into the point of hurting aviation itself? As I said, I don't have any simple solution. I know technically and theoretically, Ed is right, but in practical application, we are hurt by this type of hearing, just as you gentlemen are hurt when they have the lawyers in an accident investigation hearing outnumbering the technical experts. I would like to see, for one, perhaps a revision, perhaps a close look at the techniques of the accident hearing, to somehow correct the distortions, not only the press but your airborne ambulance chasers, so the people trying to find out the case of the accident are not going to be hand-strung by those who have axes to grind at an accident hearing, whether it be a reporter trying to get a headline or a lawyer trying to get facts for a lawsuit before the wreckage stops burning.

I would ask Ed, for example, to apply his very worthwhile knowledge, and I'll admit democratic, let the press cover public hearings. I would ask him to apply that okay. Let the press investigate the daily mechanicals.

Now Jerry said that if this colleague of his had ever been let in to look at the daily mechanicals to analyze them, inspect them, he would have been educated and he would have written a very fine, fair and objective story. Baloney. I don't think he would because the whole trouble with the press today is that they have pre-conceived, pre-judged attitudes toward the story they are writing. It comes out in almost every press conference I've seen or attended, as the one Bill McGruder has been running into every place he goes. Again, no panacea. I agree with Ed. I still think there is a better way and maybe through the questions and further speakers, we can arrive at some kind of conclusion.

Thank you.

SESSION 3

"Accident Investigator's Role --- Public Relations and the Press"

MR. VERNON HOUGLAND, AP

I had made a few notes of things I wanted to say but one by one I've had to scratch them off as my colleagues have gone through the same points. They said it much better than I could. In addition, George stole my book. I had enough foresight to bring one along and I might add that if Jerry Lederer doesn't provide you with enough copies, additional copies may be obtained from the Aviation Space Writers Association at 101 Greenwood Avenue, Quakertown, Pennsylvania 19046.

My experience in reporting goes back to the early 30's in Montana, Idaho, Utah, and Colorado. We had a lot of plane crashes in those days and the coverage had proved in many respects disastrous, since in those days a plane crash was such a terrible and tragic front page event that it would hurt aviation for some weeks after and scare people away from flying. That has changed somewhat and facilities for covering these things have greatly improved, thanks to, particularly, Ed Slattery, with his organization here on the Safety Board. We particularly find useful Ed's summaries of the general aviation accidents. They don't get the play that the major airline reports do -- just detailed attention. But, in total, they mean quite a bit in pointing out the localities involved, what went wrong, what could be done to prevent recurrence and point up the evils of alcohol intoxication. That always makes quite a sensational story, but the stories do have a positive effect in that they warn pilots doubly against that problem. We will always have the problem since newcomers to the field, persons completely ignorant of an airplane, will cover aircraft crashes.

In most cases, the accident investigator is a very important source of information. If he refuses to give it out or can't, the reporter necessarily will go to some lesser informed person and come out with a badly distorted story. Investigators need to be aware, too, of the need for speed in a reporter's life. He cannot wait til tomorrow or the day after tomorrow for information he needs. He needs it now, if it's available. And so you can get along that line for improved information.

I believe that the other parts have been taken care of by the other speakers, so I will yield to Tench.

SESSION 3

"Accident Investigator's Role --- Public Relations and the Press"

Paper read by:
DEPUTY CHIEF INSPECTOR OF ACCIDENTS U.K.
MR. W. H. TENCH

Aircraft accidents are big news and the traveling public have the right to know just how safe their vehicles are and since, unlike the car or train they all know and understand, the modern aircraft is complicated beyond their normal comprehension, they look, rightly, to us, the accident investigators, to tell them what it is all about. We must, therefore, recognize our responsibility to the public whilst at the same time maintaining our cherished and traditional standpoint of saying nothing until we are certain of our facts.

In the U.K. we also have the consideration of Ministerial responsibility to Parliament which means that Parliament wishes to be informed accurately and quickly of the events for which the Minister, in our case the Secretary of State for Trade and Industry (formerly the Board of Trade), is responsible.

There is a balance to be struck here between these seemingly conflicting issues which can be broadly met by the criterion that what is established fact in the investigation can be made known to the press at an early stage, provided its knowledge in no way prejudices the progress of the investigation whilst all opinion, judgement, assessment, decision taking and the like are beyond the prerogative of the investigator in the field and should not be the subject of comment at the early stages.

To disseminate information in this day and age of deadlines and all the considerations, the press and television news media, it is necessary to employ the specialist Press Officer. We have an arrangement of attaching a Government Press Officer to the Investigator-in-Charge at the site of a large accident.

Annex 13 requires certain information to be sent to ICAO within 30 days of an accident, which in its most liberal interpretation can include just about any accident that happens, and if you are not quick to comply with this you will get a very courteous letter from Russ Watts' office reminding you of your neglect. We regard this information as being public knowledge once the Subsequent Notification, in accordance with Appendix 2 of Annex 13, is passed to ICAO, and it can include an indication of precautionary actions taken or under consideration.

For many years we produced as an internal administrative action a preliminary report on every accident upon which a great deal of time and thought were devoted notwithstanding the early stage at which it had to be produced. It is our experience that, looking back at them in retrospect in the light of the final report, there were undeniably cases where the information at the early stage by no means conveyed the relevant information in its true perspectives. One must avoid at all costs being exposed to the temptation to represent a particular fact or event in a manner which is in agreement with one's original description if the integrity and impartiality of the investigator is to be maintained.

We do recognize the insurance companies or the potential litigant as having a special right during the field inquiry stage to more information than is released to the public at that time though if they ask a single question of fact which would not prejudice the investigation we will give them the answer. When, at a later stage, the serious business of Party A suing Party B gets underway we are subject to the normal laws of the land that apply to the discovery of evidence.

In short, the press have their job to do. If you make arrangements to help them rather than merely answering their questions they may be able to help you. A statement that a certain piece of wreckage may have fallen from the aircraft a mile or so before impact together with a request for people to keep their eyes open for it may bear fruit. We do not try to restrict the photography by the press at accident sites but we discourage by every reasonable means photography of victims who are fatalities. In allowing press photographers on an accident site, we make sure, of course, that they understand they may touch nothing.

SESSION 3

"Accident Investigator's Role --- Public Relations and the Press"

MR. J. R. GREENWOOD, FAA

Thank you very much, George.

It's certainly an honor for me to be here, especially in the company of such distinguished personages as we have here at the head table. I'm a relatively newcomer to the government service. In fact, I feel kind of like the bridegroom on the first night of his honeymoon. I know why I'm here but I don't know how to begin. The only thing about being the anchor man on a program of this kind, you can wipe out a good deal of your material by the time you mount the podium. I thought this afternoon, very briefly, I'd make a few comments on the FAA's role in responding to the news media following major accidents and there is a distinction between the kinds of information furnished by the NTSB Press Office and that normally provided by FAA and because the Board is in charge of accident investigation, it has responsibility for determining probable cause. The FAA people stay clear of discussing these aspects with reporters. We defer to the NTSB, specifically to our good friend, Ed Slattery and his associate Brad Dunbar, the questions in any area that concern the investigation in to the cause, but FAA does have an obligation to provide certain information when requested by the press on matters of fact and as long as these are within the agency's province. These areas might include the history of the flight, the number of passengers, the flight plan and the last ATC contact. In addition, we can talk about aircraft airworthiness and crashworthiness and about airworthiness directives that may have been recently published on the aircraft type involved in the accident. We also cover certification of the aircraft and of the owner-operator, the pilot qualifications and ratings and the pilot's current medical status, the ATC procedures and rules and the weather conditions, the airport navigation aids and, for example, whether any inoperative Nav aids have been reported. Also, transcripts and tapes of ATC communications or FAA records that may be released to the public. Such release would be coordinated with NTSB first to determine whether anything on the tape may bear on the probable cause.

The usual procedure is to arrange for the press to listen to the tape and have them make their own copies of it. The FAA may grant interviews to help reporters better understand backgrounds, such as cockpit procedures, traffic control procedures, and also by way of background, a brief tour of a tower or a center may be arranged to enable a reporter to see how ATC actually performs. We explained that FAA's role in accident investigation is to support the Board to examine those areas in which it has primary responsibility. That is, to determine whether any FAA rules have been violated, the operations and the performance of the navigation aids, aircraft airworthiness, and when the plane was last inspected and maintained. Also, the competency of airmen and the operator qualifications. Our press office coordinates release of information with regional counterparts. Now, on big accidents when we get a lot of phone calls, as we have recently, we look to a specialist in the press office to stay on top of the latest information and then brief other members of the staff.

Sometimes FAA may take certificate action against an operator or an airman prior to the Board's examination of probable cause. Now this action by FAA, taken in the interest of public safety, should not at any time be associated with probable cause. Also, in the course of accident investigation, if the FAA determines that a rule should be tightened or a procedure changed, or a navigation aid adjusted, and so forth, this, too, falls in FAA's area of responsibility and is not to be taken as an infringement on the Board's function. I'd like to say that I think the relationship between Ed Slattery's office and our office at FAA is at the highest level. Ed, for example, will call us and brief us on an upcoming safety recommendation or report well in advance of its public release. This gives us an opportunity to prepare for responses to news media inquiries that generally follow the reports or recommendations going into the public docket. Our FAA Field Public Affairs Officers often assist NTSB at hearings by helping to clarify technical aspects of certain testimony. In Alaska our Regional Office has worked out information arrangements with the NTSB office to release news on their behalf whenever there is a **major** aircraft accident or one that would generate news media interest. This arrangement has worked out very successfully in the past and all factual news is released by the FAA Public Affairs Officers, crediting the **National Transportation Safety Board** as the source.

I'd like to say that, in summing up, in our role, we limit our press inquiry response to the who, what, when and where, but we do not get into the why, because that's the NTSB's problem.

Thank you very much.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 4

November 3, 9:00 A.M.

"Typical Accident Investigation
and Associated Problems"

Moderator: Carl Christenson, UAL

Washington, D. C.

SESSION 4

"Typical Accident Investigation and Associated Problems"

MR. CARL CHRISTENSON, UAL - MODERATOR

Thank you, Jerry. The interference in an open mike is always somewhat like a cockpit voice recorder. There's always that critical portion that's interrupted or interefered with that causes you a lot of problems. Bob Rudich tells me that this is an open mike, and if you have something to say that you don't want recorded, why just tell him so and he'll shut it off. An open mike is always something you have to be a little cautious about.

Many years ago, I was flying over Salt Lake and Cheyenne in a 247. I was an avid hunter and I had a new copilot along with me that morning. We were going down across the Red Desert just north of Preston over an old waterhole. I said to my young friend, "Do you see that big buck down there?" He says, "I sure do." And I said, "Well, I'll be over here Saturday to pick him up." And loud and clear over the loudspeaker through the headphones came, "The hell you will. You're going to fly Flight 4." Well, I flew Flight 4 and when I got back I drove by this guy's garage and there was my buck hanging there. So, you never know.

This morning, our panel is going to be talking about accident investigations from the canyons of Brooklyn to the tip most top of Medicine Bow Peak and the Santa Monica Bay and we can add the bottom of the Grand Canyon. I've been there on every one of them.

I will not go into autobiographies this morning because you all know the panel. George Van Epps, who has been with us on many, many serious cases and has always contributed a great deal as well as conducted an excellent investigation. My good friend, Tom Saunders, formerly the military and member SAC for many years and now has become an expert - and I think there's a little competition between Tom and Bill - about who has the record for the deepest penetration into the Santa Monica Bay. Bill Lamb, of course, is going to be talking about mountains. I guess he's been higher or just as high as Tom, so there's always a little competitive personal interest that goes along with this. And I didn't mean extracurricular high.

But I think one of the things that we'll learn a little about this morning is the fact that the organization and management of an accident investigation is the most important element throughout the entire period. When it is conducted on the basis of mutual trust and confidence and it is objective, and the team works together throughout the entire investigation and individuals are not permitted to run their own investigation in every participating field, we find that we can come up with the answers.

The cost of recovery in certain types of accidents is a very serious thing to a lot of people. But again, industry participation and government participation can cut down at least the allocated cost to the participating members.

To start our panel off this morning, George Van Epps will give us a little bit about, I believe, the Brooklyn accident and the problems associated with that particular kind of problem. George...

SESSION 4

"Typical Accident Investigation and Associated Problems"

MR. GEORGE A. VAN EPPS, NTSB - "Accidents Occurring in Populated Areas"

An aircraft accident occurring in any area may generate the need for several types of investigations and there may be several different agencies charged with certain responsibilities; however, since the National Transportation Safety Board is the only federal agency charged with conducting civil aircraft accident investigations for causal determination and it has the authority to secure wreckage and records, it becomes the number one priority investigation.

During the conduct of the Safety Board's investigation, the FAA, the owner/operator, the manufacturer, union representatives and all other direct interested parties engage in a coordinated effort to accomplish the task. This paper will be presented with the understanding that the problems referred to are those experienced by the entire investigative group. Since the Safety Board has the overall responsibility, it must also try to find ways and means to diminish the problems that occur in a populated area. This paper is directed toward that effort.

An aircraft accident investigation requires an organized effort, no matter what size aircraft, how many involved or where it is. There are many factors that must be considered in advance and adjustments will be necessary to correspond with the local environment. Populated areas like all other places have their own problems and each accident will be different; however, we must do all we can to meet with the variety of problems. There are certain known facts that we have experienced as follows:

We know that persons on the ground and property may be involved as well as the aircraft or aircrafts and the occupants. Removal of persons involved, fatal, injured or otherwise, must be expedited and wreckage must be protected.

We know that a law enforcing agency, men and equipment from fire fighting units, physicians, clergymen, and disaster groups may be present.

We know that large crowds will gather. This will include the curious, the relatives, the news media, the legal representatives and many others. The vast number of people collecting at a scene presents a serious problem and prearranged police action can be helpful. Preferred routes to the scene must remain open.

We know that immediate security must be established at the scene, certain on-scene investigation must take place, and at a given time the wreckage must be removed and the area restored as much as possible.

The mechanics of conducting an investigation in a populated area are no different than those for any other place; however, the establishing of the ways and means to cut down problems in the populated area is vitally important.

One of the first chores to be accomplished is to establish the Safety Board's identity and to find a way for proper communication. The key man principle appears to be most advantageous for this and to help with most all the problems.

The key man program involves officials of city, town or county that we as investigators can communicate with on a first-name basis. They may be the mayor or his assistants, the commissioners and deputies of the police and fire departments, airport managers, state aeronautics directors, local aviation units, civilian defense director and airline station managers.

The program requires conducting frequent meetings with the necessary key people of a given area for the purpose of devising ways and means to carry out the following programs:

- 1A Notification
- 1B Rescue work, temporary hospital and morgue.
2. Fire fighting and wreckage protection.
3. Security at the scene and what to do for the investigation before we arrive.
4. Preferred routing to the scene for authorized persons.
5. Establishing headquarters with telephone, meeting rooms, etc.
6. Advise news media that a press conference will be held when the appropriate NTSB official arrives.
7. How best to control a large assembly of people.

During the on-scene investigation, if we have a wreckage scatter pattern in a populated area, residents and others often recover parts of the aircraft. Some do not know who to give the part to or they may be reluctant to give it up. The newspaper, television and radio are very helpful in these cases.

Moving in the necessary equipment to work with at the scene and for moving wreckage many times presents a problem. We must consider that we are trespassing, causing additional damage to property and streets and probably irritating many of the residents. The local councilman is normally our best help in this area. Public dissension is another problem that requires the help of the city officials.

The foregoing represents many of the major problems experienced when an aircraft accident occurs in a populated area. We find that there is a tremendous amount of interest by all concerned to do what they can without additional expense. Most of the populated areas outside the New York complex will provide some help in guarding wreckage, however, after the wreckage is secured and the occupants taken care of, they generally expect the airline and the government to stand the expense. In the northeast region we have made some strides in setting up an aircraft disaster plan; however, there is much to be done. In the New York complex we have been very fortunate to come up with an aircraft disaster plan which takes in account most all of the problems listed by this paper.

SESSION 4

"Typical Accident Investigation and Associated Problems"

MR. WILLIAM LAMB, NTSB - "Accidents Occurring in Mountainous Areas"

Thank you, Carl.

Actually, following Mr. Van Epps is rather a difficult task, but I was reminded yesterday when I was sitting back there and again this morning. I was listening to Mr. Tench and he was telling how he felt much like a bridegroom in not knowing what to do; he knew what to do but he didn't know how to do it, or some such nonsense, and the very next thing that he came up with was the fact that listening to others he got rid of all of his excess and then mounted the podium. Well, I suppose that all of these things would have something to do with safety, but I didn't know that it was in the aircraft. I was beginning to worry, but he pulled us out of it easily.

The problems that we have when we get out into the isolated areas are really categorized in the same way that the others are. Locating, the accessibility, logistics, your communications. The problems are magnified when you start having to move into the real remote areas or taking it up the side of a mountain. First of all, mountainous terrain peaks and all that are lauded by the poets, travel bureaus and everything, become our Nemesis. Not only are they the very things that make our job all the more harder in locating the wreckage. They're the ones that give us the most problem in getting into the area, getting our personnel there, bringing out any of the pieces that we need, and making sure that after we're finished the pieces we don't need and leave there are going to remain there and not wind up in some junk shop's floor later on. Because no matter how hard it is for us to get there, those people have ways of getting in and getting back out again. I wish we could find their secret because they bring out and six months later you find an engine that you thought was buried in an inaccessible place laying on somebody's floor being overhauled so it could be used on another airline.

The other part that the terrain feature itself plays in it, even though an aircraft is being very closely monitored and watched on radar, as soon as it gets down behind the shielding effects of the peaks, we lose contact and it can be lost just as effectively as if it had been lost two weeks before and a good friend walks in and says, "Hey, Joe Blow hasn't shown up from a flight." Our problems of locating would be simplified, and I stress the be, when the locator beacons are in use and have been proven out. The one problem I foresee with this is that usually our aircraft are impacting into a sheer face or a sloping face which tends to have all of the wreckage moved forward into one pile and start a great big fire and all of the equipment that you really want seems to be damaged at that time. Our locator beacons, as well as our voice recorders and our flight recorders, must be protected against that circumstance. After we have located the site of the wreckage, the next means is to decide how you're going to get there. Of course, there are two major routes, two ways of doing it. One is helicopter; the other is the old land route, climbing,

scaling, or otherwise. If you have the land route, you're lucky and your problems are diminished by that number. If you can get in by a logging trail into close proximity even cutting, wasting a couple of days cutting an access road into it, will save you time in the long run. Also, it makes your task that much easier of bringing out the parts of the wreckage that you need to look at later on.

If you have to pack or climb in, this reduces the number of people that are going to go along. Also, when you start using a helicopter to transport people in, you're going to have to reduce the number of people that you take into the site. Even if you have a landing site close by, and you have good helicopter support from the military or otherwise, you increase your dangers by the number of flights that you take in there. It is a risky situation. The experience of the crews has a lot to do with it because the probability goes up when you make extra flights into the area just to carry other people in so that they can take a look and come back and tell their organizations. We've got to eliminate those type of people from going to the scene.

Another situation that must be considered by all parties prior to the organization meeting, when it's in a mountainous locale, consider what the age of your investigators that you're going to send along and their experience. Just by looking around the room, it is very obvious that most of us, well most of you, are toward the senior citizen side and not the flame of youth. Therefore, we have got to consider the hardships that are going to be faced by these personnel going in. The very men that you need in there to do the job from the airlines, from the manufacturer or otherwise, have got to have a lot of experience so that they know what they're talking about when they're in there looking at it. These people are approaching the elderly side of it, so physical fitness and physical limitations has a lot to do with it and the coordinators for each of the parties must screen these people before recommending them to the various groups.

Another thing that the Board must do, we've got to accept the fact that here we do have older people at unsure footing conditions and at higher elevations, and we're going to have to reduce the number of working hours that these people are exposed to at that time. The knowledge that's gained by one man if he comes back off of the mountain and then has a heart attack and is laid up for six months and you can't get to him to get the information out of him doesn't do you very much good. We have got to work together in order to be able to have the complete coverage of all of the aspects of the wreckage that are on this mountainside. This information is brought back to headquarters so that headquarters coordinators can assist in making a decision as to what we're going to have to bring out of there, if anything.

Now, in the matter of after you get the personnel on the side of the mountain or wherever it might be, the one thing you'd have to look out for ahead of time is to have emergency shelter available for them. No matter how complete your helicopter airlift might be or things of this nature, the weather has a very mean way of moving in at the wrong time and in a very rapid manner and you may have to leave people on the side of that mountain overnight or a day or two. Again, their safety and welfare have got to be considered ahead of time so you must move into position, whether you ever use it or not, some type of shelter that can be used in emergency in case they are stranded on the side of the mountain. At the same time, you must have emergency food in the area. Now, usually the guarding of that emergency food to keep some of our investigators from eating it because after they go past four hours, it's an emergency as far as they're concerned, they'll get into your C rations and no matter how unpalatable they are, they'll eat them. However, we do have to

provide things of that nature for the investigators on the side of the mountain.

One of the first things that you should do when you get into the area, and before you let anybody on the side of the mountain start to work, is to enlist the aid of a local mountain-climbing rescue group, forest ranger or whatever is available in that area. Get him in there to advise what personal equipment these men must be equipped with, whether he's got to have a special type for the type of soil or the type of rock, shale or otherwise, the face of the area that you're working on, whether he needs special outer clothing for the types of changes of weather that can be experienced in that area. These people can give you invaluable assistance. Also, try your best to get someone of those people to go in with one of your groups as a liaison man, so he can advise them and keep them from getting into too much trouble.

The very one thing that we in the safety business are probably the worst offenders at, we're in, working around debris, sharp edges and everything else and 99 percent of the time none of us have on hardhats. You go up on the mountainous area, a hardhat becomes even more of a requirement, because if you have timber in the area, you're going to have debris and things like this hanging up in the sides of trees, above your head, and burned and charred types of trees and things like that may fall on you. The slope is such that you will probably have falling rock or moving debris when you move a piece of wreckage, so we must insist, and I think it ought to be standard practice, that anytime you work in and around wreckage, those personnel have on hardhats. I'm sure that (Surge) Douglas wouldn't argue that point because we did have occasion of putting up a Huey Helicopter loaded with ten of our investigators that sort of missed its landing approach in the area out at (Weenie), Oregon, and rolled down the side of the hill and after Surge looked at the three inch long, quarter-inch gouges in the side of his hardhat, he was convinced that that was a very good, sound piece of equipment. Although, prior to that time it was an annoyance.

There are several ways after we get into the area of bringing out the equipment or pieces of wreckage that we're going to need. I don't advocate the way that I was first trained on my first major accident into the side of a mountain and one of our senior power plants experts had to actually tie his R-2800 to various trees, etc., around, using rope to hold him on the side of the slope, because after he removed parts of it so that they could get into the parts of the engine and take a look and move the stuff out from around it, it was not very securely held on the side of the mountain. The particular airline came to him and said, well, we would like to have that particular engine down off the mountain. And he said, "You would?" He said, "Yes." He says, "Okay." So, he stood back and took a knife and cut the rope and it went down the mountain. The only thing down at the bottom of the mountain was a railroad track that he displaced about six feet and then it bounced out in the middle of the river and was lost for good. But you can get them off the mountainside that way. We're not going to verify the condition that you're going to be working with following that, but that is one method.

We have one piece of equipment that is coming along now that will assist us in the observation of the wreckage as it is on the side of the mountain, a close look at the parts, bring it off so that the headquarters staff can look at it, and make an evaluation as to whether we are going to need to remove this piece of equipment or piece of wreckage or whether or not it can

be studied on the mountainside in sufficient detail. At the present time, we have one piece of this gear that's being utilized by another branch in another division. I don't know exactly what they're using it for. I heard a report that came out just after the President's report on pornography, they said this was probably one of the greatest boons to pronography that had ever been invented, but this is the portable T.V. camera that has instant replay capabilities. You can take it to the side of the mountain. You can take close-ups. You can look at the wreckage scene as it is, bring it back out and let the people at headquarters view it and make a decision as to what must be moved. This will be of definite benefit to us. At the present time, it's still in its formative stages.

The other item that must be considered in your mountainside investigations is your communications system. The better the communication, the easier the job and the more rapidly you can complete it. To that point, you should try to get as extensive a communication system as you possibly can moved in. That would mean if you're out operating at a base camp at the foot of a mountain, you would probably have console-type communications installation that could be brought in by the military. You would move another one of those console-types as close to the scene of the accident as possible and then communicate between that point and the wreckage site by a net of walkie-talkies. If at all possible, prepare and try to get your communications so that the people using the walkie-talkies can patch through the console set directly to headquarters. When you have that, then the problems that come up don't lose their impact the number of times they are relayed and the changes in the verbage as they come down the side of the mountain making the desire for Sam Jones to come up to some other means. But I can't stress the importance of the communications system because in order to talk with each other, the headquarters is then able to relay back to their parent organization the need for additional people, the need for additional equipment or whatever is necessary so you can get it in and move it in.

We have the problems sort of isolated down to location of the wreckage, the accessibility of it, getting your personnel and equipment in there, but one area that I did skip over rather lightly was the search and locating portion of it. You can do a lot in this area, even though it may come under some organization's responsibility to oversee the search, you can coordinate the search to the point and advise them to get everyone in so that you are making one concentrated search. You should discourage individual efforts because, especially in the winter in the mountainous areas, the saying that the portion of the search area that you cover today may be well covered tomorrow by snow is extremely accurate. Therefore, all of these people, when you cover one area, you want to make sure that it's sterile. If you have individual efforts going on and well-meaning group of people over here from mountainside go out and they search one area and they come back and say there's nothing in there, you don't know the means that they used to cover it. You don't know how completely they have covered it nor to what depth and, therefore, when you go back in and research that area, you're going to cause nothing but ill will and hard feelings from those people. So the easiest thing to do is to try to get everybody together and do it at one time.

Thank you, gentlemen.

SESSION 4

"Typical Accident Investigation
and Associated Problems"

MR. THOMAS SAUNDERS, NTSB - "Accidents Occurring in the Sea"

Thank you, Carl.

I hate to start off a presentation by apologizing or saying something that needs to be said, but the Director stood up here yesterday and accused me of being a con-man. Well, I'd like to straighten the record out. I'm really not a con-man. I'm not like the little boy who played naval aviator in a soap box with his girl friend. I'm not a real con man.

My presentation will be in two parts. I have no formal paper. I will use a flip chart initially and then I have a series of slides that will show you what we saw during the Santa Monica investigation on United Airlines.

Again, I'll have to apologize. Those of you back in the seventh row may not be able to see my charts. I can come to you or you can come to me.

As you are well aware, the title is underwater investigation. And you see, Mr. Tench, the first item here is search. We found in this case, in this phase, that the constituted authority, the Coast Guard, delivered us some 1,500 pounds of floatables and quit. Their statute ran out, you might say. Then it became dependent upon us to continue the search. We had one radar fix on the airplane; the last radar fix and the search was originated from that point.

It would appear that that would be a simple search, but that's not quite true. This radar fix was some 1,200 feet in the air. The airplane was going some "x" knots and some "y" rate of descent. So, at that point in time, it became obvious that we had better divide this investigation up in phases. And those phases, you see them there.

The search and rescue phase, of course. The next phase we call is identification and plotting. We are concerned with the wreckage on the bottom of the sea. We are concerned how it was orientated and where it was located.

The next phase we were to concentrate on was the recovery of priority items. Here we're talking about flight recorders and in that case, we were also concerned with engines and some electronic equipment.

The final phase, it was obvious, that we would have to get more than the priority items. That was the trawling or seining phase. These three phases we will show you on the slides.

Here are three basic types of underwater investigations. Over here, we are showing depths of water, 200 feet, 600 feet. Down at 200 feet, there's no problem with scuba diving. Even a hard hat and seining is not a problem. So, down to 200 feet, your problems are much less. Then we go to 600 feet.

From about 200 feet to 600 feet, you do have hard-hat-diver capability. You cannot use scubas. With mixed gas the diver can operate at 600 feet. His time is limited. He may have some problems with lung muscles. The pressure at that depth of the water prevents the diver from pulling. All his maneuvers have to be pushing. So, you're really limited at 600 feet with mixed gas, hard-hat divers. There is some capability of a bell which takes the diver down which merely extends his time on the bottom.

If it's above 600 feet, you'd better start thinking about something else. You must, if the man is to go, have a submersible; it must have the capability of lift, it must have a capability of dissecting the wreckage. You can use the cage with a TV camera, which we used in phase 2. There are some draw-backs on the TV camera, black and white. And you can use the trawler. It appears to us that based on the experience on the United at Santa Monica, you could say that the bottom part of that 600 foot block could go 8,000 feet, because we have some submersibles that could go to 8,000 feet. So, those are some of the basic types, you might say, on how to approach an underwater investigation in relation to the depth of the water.

Now, I was thinking a bit about the organizational requirement of manning an investigation under the water of say, 1,000 feet deep. The first thing the investigator has got to realize is that he's not the expert any more. You have to look to the outside of the government, outside of industry, or the manufacturer, or what have you, for this expertise. You need an overall manager to lash this show together.

Then, of course, the third item is cost. This is where the con artist comes in. You will probably hear me talking about cost but it's with us and I think we should put it on the table today and beat it around awhile as far as the international situation goes. It is a real problem.

Now, we know our basic requirements, so we must organize to insure that we meet those requirements. Here is a functional organization which we really actually used in the United case in Santa Monica. You can see here sits the NTSB. Here sits the special expertise, the manager, that we are talking about. The dotted line means that's a contractual, managerial situation. I didn't say money, but that's money again.

Over here on the other side is the air carrier. You see, he's connected here, and he's connected here, and he talks to me or the investigator in charge on money matters - contractual. In this case, the operator agreed to do the physical contract, to hire the special manager, who will lash together the special equipment, the vessels, the navigation and communications that we might need. Speaking of communications, I'll touch on that a little bit later. But it does work. The United kit was the communications from the sub to the surface, and we were able to work on the bottom of the surface of the sea, identify part numbers, call them to the surface, radio them to the shore, and call the Boeing people. And within 15 to 20 minutes, we would know where we were by that part number. So communications is a vital process.

Now again from the managerial standpoint, the special manager will take care of hiring the vessels, putting the special equipment on board and insure navigation. One word on navigation.

We were lucky on the United in Santa Monica. We had a line of sight. We used Lewis and Lewis - it's a type of Loran. Of course, we had three feet accuracy at the mast. The antenna was on the mast of the boat, and we could plot within three feet of those identified objects on the bottom of the sea. Navigation is critical and when you get away from the line of sight, the problem is compounded.

So you can see here is NTSB. We have organized the investigation, and we also see the operator, the air carrier seen here. His people are members of the groups. You see the manufacturer sitting here, and of course, FAA and all the other people - ALPA, FEIA, etc., - who help us in our investigation. We've organized this into investigative groups. The special manager, under the guidance of the investigator in charge and contractual, managerial services from the operator, the money people. These people are then able to go aboard the vessels and there we do our investigation.

Of course, you see the maps on the wall which show the command post. The man talking to me there is the engine man - power plants. In phase 2 of the investigation, we had to make a decision. We were looking for recorders and did not want to disturb the wreckage, even though we did have an indication of power plant problem. He's besieging me to pull the engine up. We know where they are. They're laying in a 100-foot circle. He wants those engines on deck right now rather than plotting the rest of the wreckage and continue the search for the recorders. Well, we finally got around to granting his wishes.

Now, this is the Ocean Air, an ocean-science research vessel. During the search phase, sonar bomb was used and a plot of the wreckage on the bottom of the sea was made which was later compared to the phase 2 identification and plotting. And here, believe it or not, they come out as an overlay.

Here is the special equipment that we had during phase 2. This is Jacobsen's Company J Star which was on board the Ocean Air, owned by Ocean Science and navigated by Lewis and Lewis. You can see there that it does have sonar, a TV camera and hydraulic cylinders and clamps. This cage is maneuverable by the Ocean Air. The cage in this case is maneuverable within a 500 foot side square. So we were able to cover the whole territory there. You pick up the target on the sonar and you track in by moving its cables till you get the TV in range, and the visibility most of the time, using the cage, was around 12 or 15 feet. So, the sonar gave you the initial direction. You maneuvered the cage and then you picked it up with a TV camera.

Here we see it going over the side. It takes about 20 minutes to get it down there. Here we see that engine man again. This is the control panel of that J Star. That's the TV camera and he's got his hands on the lever there which maneuvers the cage to ride on the bottom of the sea. Now, he's still after his engine and we're looking for recorders. Well, after the plot was complete, about 4 o'clock in the morning, he had one on board and you can see he's happy. Well, the engines were located early in the game and they laid there where we knew where they were and we could go back to them in minutes. They laid there for quite a few days and when phase 2 was over, we pulled them up. It took us about 15 hours to get all three engines on the deck and about three or four hours for the boat to make it to the dock. So, that's the end of phase 2. We plotted the wreckage and brought the engines up. Unfortunately, the problem involved with black and white TV is we couldn't

see the international orange colors of the recorders; although some of us are convinced we saw one of them. But it didn't show up, so we kind of ignored it and got it later.

Now, the next phase was where we took the submersible and established priority: flight recorders were first. This is a view of the Deep Quest. It's a Lockheed vessel. We're getting ready to launch on the second dive. It'll move these pretty fast as you can see.

You can see in the distance there, one of the bouys, one of the three-point bouys, to which the Ocean Air was originally moored, in which the cage was then able to operate in its local sphere from a bouy of that type. When Lockheed came in, they wanted us to keep Lewis and Lewis navigation on the shore, because they weren't quite sure that those bouys were placed correctly. The first trip out, Carl and I convinced him that if you drop your beacon right in the middle of those three markers, you will hit the center of the wreckage. Well, there were some apprehensive people on board the mother ship of the Deep Quest as to the validity of the position of the markers. Well, they hit right in the middle of the wreckage.

This is typical of recovery. Unfortunately, you aren't going to be able to see them real well and I hope this photograph will show it. But this vessel has a view that you can look out directly, right in front of it. It has two mechanical arms that are manipulated, believe it or not, by switches and not by hand grips inside the vessel.

On the second dive we did navigate it to what we had identified in phase 2 as the aft stairway in the wreckage. We were looking for the recorders. Now, we started unstacking this wreckage with the mechanical arms and time starts running out on us. Low tide comes and we still don't see the international orange. So we became concerned. Are we really in the ventral area or not. So, communications again. This is where I was able to call to service with the part number, radio to the shore, to Boeing and back to us in twenty minutes and we knew we were in the left ventral stairway wreckage area. So we moved slightly to the right. Unfortunately, it's getting to be 5 o'clock in the afternoon and we brought home the lid of the flight recorder. We didn't see the flight recorder that day. But we knew that we were in the right area.

With the completion of phase 3, now we're talking about three and a half weeks down the pike. We had planned one phase, in the original cost, to be around \$150,000. Due to weather, approximately 80 percent and the rest due to mechanical of various nature.

The next schedule was around \$175,000 or \$200,000. Here, we're looking at the third schedule. This is phase 4, the trawler. The least costly of the operations. The submersible, of course, was the most costly. Almost the same though as phase 2 with the special equipment on board.

So, we have our recorders now, our engines and it's time to sing. This is the operation with the net. You can see the net trailing behind. Again, navigation was critical. We had to put Lewis and Lewis back on the mountain side. This boat had the capability then of navigating within three feet. With the wreckage plot developed in phase 2, Lewis and Lewis navigation had no problem finding the wreckage and seining it out.

This is the type of wreckage that came up in seining. There are some large pieces that also came up. There was one piece down there imbedded in the ground. We haven't identified it yet. We seem to hang on a heavy structural part. We didn't get it up. We got about 66 percent of the aircraft wreckage.

Here's that man in the sea. You can see that international orange. With the submarine, we spent, we didn't document it, but a tremendous amount of time was spent down there to get through the viewer, you get an international orange flash. Those are the recorders. So you head over there and that's the type of recorder you usually found. So we feel, and I've made recommendations, perhaps our recorders, instead of being a pure international orange, they should stripe them. Perhaps with tape that would show up on black and white TV.

Here we are at dock phase, phase 4. Here it is being unloaded. Now, we'll go on to the wreckage in the barn. This is what it looked like. You can see the extreme fragmentation.

And that completes my formal presentation, gentlemen, and I'll turn it back over to Carl for questions.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 5

November 3, 10:30 A.M.

"Conduct of an Investigation
...Part I"

Moderator: James Childs, NTSB

Washington, D. C.

SESSION 5

"Conduct of an Investigation ...Part I"

MR. JAMES CHILDS, NTSB - MODERATOR

Thank you very much, Jerry. This is the second honor that has been given me in this conference. Standing in for Mr. Roscoe - that's quite an honor in itself to try to moderate in his place.

But firstly, to be able to work with Jerry Lederer and two of his very hard-working men, Jimmy Behram - the gentleman you see running around here keeping things in order - and Chuck Connaway, who helped set up the hotel and the other facilities which we're using now.

The previous presentations dealt with the organization of major groups, special types of investigations, the legal aspects that cover these organizations and investigations, and the association and dealing with the press.

Beginning with this session, we will try to start the organization, the notification and dealing with a standard type of accident investigation. We will try to cover certain problems associated with an investigation, not necessarily in this order but basically covering this type of subject. The notification of the accident, the security of the wreckage, the organization of the investigation, the investigation itself, including questions of witnesses and the other aspects that are covered in a normal investigation. We would appreciate it, because we're running a little bit late in time, if you gentlemen would please refrain from asking your questions until the last speaker has had his say.

We will start with Mr. Baker. Mr. Baker is the senior, or rather the supervising, investigator in charge from the NTSB. Mr. Baker...

MR. GEORGE R. BAKER, NTSB

Good morning. I regard it a privilege and pleasure to be asked to participate as a speaker in this first SASI seminar - first international seminar - hope it's not the last - seminar or opportunity for me to speak. Some of you have come long distances. I understand 158 people registered, including persons from 40 foreign countries. I think that's wonderful.

For this time slot, your program reads, "Conduct of an Accident - Part I." Part II is concerned with, "Problems Associated with the Investigation."

Problems associated with the investigation - emphasis on the word problems.

I'm reminded of a story which you all have probably heard - seems this good looking, well built, mini skirted female was attempting to cross Connecticut Avenue near K Street, N.W. She stepped off the curb without looking, as we males know most females are prone to do, she didn't see this car coming down Connecticut Avenue. Well, the car caught her in such a way that it spun her around, tore what little clothing she had on completely

off and knocked her to the pavement, unconscious and there she lay, on her back unconscious and completely nude. A passerby, with some presence of mind, dropped a hat over her vital part so some semblance of modesty could be preserved. Well, as fate would have it, an air safety investigator wending his way from the Black Tahaiti, where he was oiling himself to get into the mood to prepare his paper for delivery at the SASI seminar, came upon the scene. The usual crowd had gathered around the prostrate girl. Our air safety investigator could see nothing. He asked one of the spectators what was going on and was told there was some sort of problem with a girl lying on the pavement. The air safety investigator sprang into action, as air safety investigators usually do. He muscled his way through the crowd, as air safety investigators sometimes have to do. Up to the prostrate girl - there she lay, nude, unconscious, with a man's hat covering her vitals. Our air safety investigator sized up the situation immediately, as air safety investigators usually do, and in a loud, clear official type voice exclaimed, "Boy, we sure do have a problem here and the first thing we have to do is get that guy out of there!"

Problems we got many of.

Proper solutions we could use more of.

The program I followed listed five areas for discussion - notification, security of the wreckage, organization of the investigation, investigation, questioning witnesses and a heading called other. In the time allotted me, I will touch briefly on all of them.

From my standpoint of experience, I'll touch on a few of the major problems I see in each area. I might offer some solutions. Because of time, I cannot cover the area completely. My approach in my presentation will be that of an employee of NTSB, an IIC, although I am also a SASI member.

My first experience in civilian accident investigation was with one I was involved in myself. I was immediately notified I was an interested party. I became interested in work, sought job, just lost mine.

1. Notification

At NTSB here in Washington, we usually receive notification of an accident from the FAA Communications Center. We don't have too many problems with getting ourselves in gear and getting to the scene.

I can see problems with being notified if you're a participant-interested party. We, NTSB, have been approached at times to notify certain parties of an accident. We, NTSB, can't help you. The NTSB is not geared to notify interested parties. We expect those interested to learn of the accident by their own means. You can expect that we (NTSB) will arrive at the scene as quickly as possible ready to work. We expect you to arrive at the scene or thereabouts as quickly as possible and ready to work.

We need all the qualified help we can get. We appreciate all the qualified help you can offer.

Receiving notification of an accident if you are a foreign operator or manufacturer, especially if you are a major component manufacturer, may be

a problem to you. Again, we can't help you. We expect you will learn of the accident and respond usually through your government. ICAO Annex 13 provides for your participation. We welcome your participation.

2. Security of the Wreckage

I wish to affirm what Mr. Tench said yesterday about security. We need to have security of the wreckage established as quickly as possible. I'm sure we all recognize the advantages of wreckage untouched by human hands, so to speak. The rules governing wreckage preservation allow for attendance to the needs of persons aboard the aircraft, alive or dead. Outside of that, the wreckage is to be left "as is" until the investigation can be organized and the investigators can go to work.

One of the first actions of an IIC when assigned to an accident investigation is to go directly to the site, regardless of time of day of arrival. He is mainly interested in seeing that security is or will be established. He is also interested in seeing the lay of the land. One observation I have made at about every accident site I have visited is that there are far too many people milling around the wreckage who have no business being there at that time. The sightseers are bad enough. Maybe our curiosity gets the best of us, but we're not doing the investigation any good by stomping through the wreckage, pushing and pulling at pieces. We need the help of all in establishing and maintaining security.

Password here might be: save the wreckage for the qualified investigators.

3. Organization of the Investigation

Contrary to what Mr. Tench said about organization, of prime importance prior to starting an investigation is holding an organizational meeting. Its purpose is to bring everybody concerned together, introduce one to another, lay the ground rules, so we can all step out on same foot. I usually try to wait to hold the organization meeting till all would be participants show, or at least representatives from interested parties arrive.

During the organization meeting, the IIC will brief all present concerning the conduct of the investigation. This is important, We want all participants to play by the same rules. We want only one investigation. An investigation conducted under the umbrella of NTSB. The big problem as I see it, in this area, is having all participants present at this meeting. At least, a representative of each interested party should be there. Although this is not as satisfactory as briefing all participants.

The password here: All participants should be present at the organization meeting.

4. Investigation

It is imperative that the personnel originally assigned to an investigation remain with the investigation until the investigation is concluded or conclusion of their respective group activities and they are relieved by the group chairman or IIC. The time element on the scene averages about ten days. (Oh, I know there have been many longer and some shorter periods.) You, as interested parties, should plan on losing your man's

services to the investigation for at least a period of ten days to two weeks.

As we go along in the investigation, we try - want - to keep each participant aware of all development. We hold progress meetings periodically. I believe it makes for a better investigation when each individual sees how his efforts fit into the overall investigation. No one should work in a vacuum. Examples: The reason we wish all participants who start out to finish up is that it takes considerable effort and time to bring a newcomer up to speed. I'm speaking about the replacement, not the new-newcomer. The individual who comes on the scene in answer to a request for more and/or specialized help. Funneling information back home becomes a problem when the information is not known to the IIC and group chairman, especially the IIC. I like to think - I want to believe - that the IIC is the most informed person involved in the investigation. It's very annoying to receive inquiries from the head shed about something they heard from somewhere and I, right in the middle of the spot where the information is being developed, am not aware of it. I'm not talking about rumors. I'm speaking of good hard information that found its way directly to an interested party headquarters, thence to my headquarters without going by way of the investigation. I'm not suggesting information be withheld from your headquarters. Just make it available to all participants first. A good practice is to funnel this information home after the progress meeting. If it can't wait, make sure your group chairman knows you are passing information home. I'll expect him to relate the information to me (if I'm the IIC) and the other participants. There should be a free exchange of information within the investigative group and a free exchange with your respective headquarters. The later information is transmitted for prevention purposes only and only after it is made available to all participants. Don't want anyone working in vacuum. In short, interested parties come ready to work - ready to stay - and ready to pass information to the participants before passing it home.

5. Questioning of Witnesses

The questioning of witnesses is an art unto itself. Most of this seminar time could be taken by this subject alone.

I'm sure you're all aware of what we are trying to accomplish in this area. A flow of information usually regarding the final moments of the aircraft involved. To keep within the confines of one investigation, all lay witnesses are interviewed by or under the cognizance of the witness group chairman. The work of the group may be divided among the members of the group, but the division is made by the group chairman. The results are reported back to the group chairman, thence, to the investigative group through the progress meeting.

A technical witness (one who has a particular expertise important to the overall investigation) will be interviewed by the most qualified NTSB investigator, with assistance, if necessary, from most qualified interested party personnel.

6. Other

Under the catchall heading of "Other", let me bring my part in these festivities to a close by mentioning some general problem areas. Bill Lamb mentioned communications.

One problem area that comes to my mind is news coverage. We don't get enough of it and usually what we do get is lopsided. Oh I don't mean that we should be strutting before the cameras, although I've been accused of doing more than my

share. We spend a lot of taxpayer money doing our thing, and the taxpayer ought to have some idea of where the money goes. He may learn if he reads the newspaper - most everybody watches TV - I'm amused, sometimes appalled, at the reports I read and see about an investigation. If I didn't know, I'd wonder who is conducting the investigation. Certainly, after all those years, I would hope the press knows who is conducting the investigation and who is assisting.

Sometimes an investigation costs a great deal of money - I mean beyond such things as normal salary of the participants, cost of their transportation to the scene, cost of their food and lodging while away from headquarters, etc. I'm talking about the cost of security, including cost of guards, cost of moving the wreckage from the smoking hole or whatever, to a suitable site for examination (in some cases, we have to build roads). Ask Bill Lamb or Tom Saunders or Carl Christenson about the cost of salvage, if you're unlucky enough to have your aircraft end up in water shallow enough for salvaging.

Where wreckage movement is involved, economics enter the picture. We have to weigh the advantage of recovering all the wreckage with the cost. When it doesn't cost anything, it's easy to say, "Let's bring everything down from the mountain or up from the sea." Contrary to popular belief, as far as NTSB is concerned, Uncle Sugar does not have unlimited funds, sort of similar to what Mr. McCabe, our Irish friend, was saying yesterday.

When the interested parties are asked to contribute money to the salvage effort, it's surprising how unimportant the wreckage can become.

To sum up -

Rely on your own methods for being notified.

Come to the site prepared to work and stay.

Keep your hands off the wreckage until you're a member of a group which requires you to do so.

Keep the information flowing within the investigation - then to your headquarters.

Help us keep and maintain security.

In short, bring people; bring patience (not sick people); bring money.

Many thanks for this opportunity.

SESSION 5

"Conduct of an Investigation ...Part I"

MR. P. GUILLEVIC, FRANCE

Thank you. I apologize because there may be some problems of the language because of my poor English and my French accent. But this forum is an international forum and it needs some foreign accent, too.

I am afraid before speaking of the conduct of inquiries, I must speak of the French accident investigation organization. I learned a lot yesterday from the U.S. and the U.K. of the organization of accident investigation in this country. I think for some people here it would be of some use to know about the French Civil Organization in general and the French work in conducting investigation in particular.

The French Civil Aviation is a part of the Ministry of Transportation. It's divided into four categories: ATC, airports, air transports and meteorology, because meteorology in France is a public service. Besides these four categories, which are in charge of regulations and in some extent of transportation of the ATC, airports, and meteorology, there is the General Inspection for Civil Aviation, which is independent of direction. And the Bureau of Air Accidents. We will call it BEA so there will be no possibility of confusion. We call it BEA. It is a part of General Inspection for Civil Aviation and is quite independent from the four categories.

The BEA has a very little number of inspectors and investigators. So there may be more in a big country like the U.S. We are obliged to cooperate with many of the state agencies or private agencies, mainly with the Director of Civil Aviation, which is in charge of certification for military and civil aircraft as well. It has all kinds of laboratories and test centers, etc. For notification of accidents we use generally the ATC lines of communication. The main informer is the airport management or the French gen d'arme police which is a French country police, which generally in accordance with an agreement with us, calls the ATC organization and through ECC of Paris, the investigator on permanent duty or the inspector on permanent duty is advised when an accident occurs and is able to go on the spot as soon as possible.

For the conduct of inquiry, technical inquiry, there are three levels. First, I must apologize and say the BEA is in charge of accidents and of incidents as well, and its role is to dispatch the information available about accidents and incidents when it is necessary to issue direct to agencies who may be interested in this fact.

There are three levels of investigation. First, the local investigation. We call it First Information Investigation which is conducted on-the-spot by the local aviation facility. It is necessary because of the shortage of our staff in the BEA. This inquiry comes up only in minor accidents or incidents.

The second level is the technical, special technical inquiry, which is conducted by the BEA on its own but at the request of the local inquiry, and is followed by a special inquiry report. And for major accidents, generally for

all big airline incidents, there is a special commission which is designated by the Minister of Transportation and which varies from year to year or from accident to accident. The composition of this commission is published in the Official French Journal. But the president, the chairman, of this special board of inquiry may be one man designated for three or four years or until retirement. Or he may be chosen from a list of three or four or five personalities, known for their competence in the aviation field. Other members are or will be representatives of aeronautical companies, representative of BEA, representative of medical officer, and maybe one or two other people. So, the reports of the Commission of Inquiry are always published in the Official Journal and available for everybody. If some foreign agency - some special investigation people - did not get a report, instructions are given for having the surplus sent to the interested countries and we'll do our best to correct this.

Another important thing in France is the difference between the legal aspect of the investigation compared to what happens in the U.K. or the U.S. The legal procedure in France is quite separate from the technical procedure. And there is something in particular in France in legal procedure. It is confidential. The findings of the hearings are not disclosed to the public until the end of the inquiry. So, anyway, it's easier for us to incorporate and conduct a technical inquiry. There particularly is no mixing of the place of the judicial inquiry or the technical inquiry, except at the very beginning of the investigation, for reasons of security, for reasons of safety of flight, there is naturally cooperation between both. What happens sometimes is that the judge in charge of the judicial information decides when experts from the BEA should make a report to him. But in this case this report is always a factual, technical report independent of any ideas of responsibility.

The only difficulty in this sort of operation is maybe the questioning of witnesses. In application of an agreement between the Ministry of Justice of France and the Ministry of Transportation, both public agencies must cooperate and then conduct their own inquiry separately or together. It seems to me the main difficulty we are in front when it happens. We are questioning crew or witnesses. Especially crews. It's evident that the pilot or any member of the crew will not answer all the questions the same way if he has in front of him a judge, policeman or investigator. We try as a maximum to limit the inquiry to prevention of the accident independent of any idea of responsibility. So when we need, we separate the interview of the crew or witnesses from questioning by people from this department or from police.

These are the particular things in the French inquiries for all those things. We need cooperation of everybody in France - laboratories, private, military officials, and also with other countries because in a country like here, it is necessary to make needs from different countries to work together. In this way, I was pleased to hear Bill Tench say yesterday that between France and the U.K. that is doing well.

Another thing is to show you an example of the cooperation that is circulating among you are photographs which were taken about 7,000 feet. That's 20 miles from the coast in a position which was unknown by seven or eight miles at the beginning. If we succeed to get some wreckage to the surface about 5,000 pounds, that will be by obtaining the cooperation of people as different as cable ships, fishermen, navy men, people from the aviation safety field. I think the job of aviation safety is the job of everybody in a country and among all countries.

Thank you.

SESSION 5

"Conduct of an Investigation
...Part I"

DR. SALAS PARRA, VENEZUELA

Thank you very much. First of all, I want to give thanks to give me the opportunity to talk here. Second, I will be very short because of my English limitations. My name is Jose Antonio Salas Parra and I work in the Ministry of Communications, and I am Chief of the Technical Department. The Technical Department is known as the Commission of Accidents. In Venezuela two years ago when I first started there, the first accident that I saw was a collision between a plane and alligator. He seemed to hit it. But the plane was rolling and they had a flat tire and they went on the side of the runway and there was an alligator. That was the first one. Twenty years ago we had an organization regarding to investigations, accident investigations. As you know, Venezuela is a country that is part of South America and they have about ten million inhabitants. It's capital is Caracas with two million inhabitants. Aviation is very important, because it's in the north part of South America and the traffic is very heavy there. We have in Venezuela for the year 1969 about 653 active planes. Eighty-four percent of those planes are general aviation planes. We have tremendous amount of international traffic in our airport. Because it is a small country, we don't have a fixed organization in accident investigation. The people you find in accident investigation are people you find in the Direction of Civil Aeronautics. We take the people from there and when the accident occurs, we designate them into different groups of investigation. We make a report at the end. We do the accident exactly in accordance with Annex 13 of ICAO. We follow that. We have had for ten years a representative in ICAO and we follow the procedures and methods that they say there. When the accident happens, we do it the way that the Annex says and we report that accident and make a report. We report that to the Director of Civil Aeronautics and to the Vice-Minister by way of the Secretary of Communications. And that immediately goes to a commission in the Congress and they release the accident report to the people that ask for them. We don't publish our reports. We have to ask.

We have in Venezuela, technical and metallurgical laboratories of the University of Caracas and we use this facility identically with that here in this country; all of our recording and laboratory testing and so forth.

In an accident in Venezuela, we divide it into two parts: international accidents. They can be of three kinds - catastrophic, non-catastrophic and incident. In national, we have the same division. The incident-accident in the national part is not investigated by us, but the Commission de Aeronautica Civil, that you can compare with the FAA here. They investigate the incidents. A non-catastrophic incident all depends on the conditions of the potential dangers that happen. We investigate it and make a special commission or we investigate it like the FAA.

So something before the end. We take special care in the notification of accidents. We notify by our ATC, our AFTN, as Annex 13 says and we notify in the same manner by the diplomatic channels of the country according to international accidents, of course. By diplomatic channels, we participate in the accident. In the last years, we have a compilation of all the accidents and incidents that have happened in Venezuela, and anyone can have them by writing to the Director of Civil Aeronautics and he will release the accident.

Thank you very much.

SESSION 5

"Conduct of an Investigation
...Part I"

↳ MR. DONALD KEMP, FAA

Thank you, Jim. I really do feel like part of the family. I have been with the Board on so many investigations in the last five years, I think I know everyone's first and last names and some of their kids.

Let's start out with the program they had lined up for us in the notification. This may come to the FAA from any source - farmer, sheriff's office, etc. It normally is sent to our nearest ATC facility, Air Traffic Control facility, and an immediate dispatch and notification is made to our Washington Communications Center.

I'd like to tell you something about this Communications Center. You'd almost have to come and visit it. If you have time, drop over to 800 Independence Avenue and I'll give you the cook's tour, but it is fantastic. We have the capability in that Communications Center of latching together 120 persons on a conference call. But we've never tried to get that many on there. Sometimes it seems like 120 when we get involved in a major accident. For example, when we do get information on an accident, the NTSB duty officer is patched in, I'm on the line, maybe three or four other people and we get all the information we can.

For example, as to how fast this actually works, in December 4, 1965, we had a midair collision up in New York. This involved TWA and Eastern and I got the call and they said we've just had a midair collision. I said where? They said New York. Well I said how many killed? They said we don't know. I said, what do you mean you don't know? They said, well, they're still flying. So this was less than two minutes after this occurred. Well, approximately an hour and a half later, the Board team, myself, Mr. Thomas, who was then with FAA, proceeded to New York and were on the scene in less than two hours after the occurrence of the accident. So you can move fast with a good communications system. And this is necessary.

Security. I won't say anything of that because we use the same procedure as the Board. We don't have too many resources, but we try to convince the insurance company or the operators or someone else to take care of the security for us.

The organization of investigations. Our initial coordination is with the Board to determine who is going, what the requirements are and how many members they will be sending if they are going to dispatch an airplane. Normally, we go in either the Jet Star or the Gulf Stream, and on short flights like New York, we sometimes use the World War - pre-World War II - the gooney bird (the DC-3). But there's not much difference in travel time to New York.

During this travel, we initially set up our coordination. Determine what teams are going to be organized. Then after arrival, prior to the organization meeting, I, in connection with our coordinator, try to get men assigned to each team that will be formed - "Ops", Maintenance Records, Human Factors, Structures, Engines, and so forth.

Normally, the airplane stays until the flight recorder and the voice recorder have been located and then they fly these two recording equipments back to Washington and the Board people meet the airplane and immediately bring it to the laboratories so we can get some good information back to the field to assist us in the field investigation.

Our investigation is identical to the Board's. In fact, we use the Board's book of accident investigation procedures, since we are delegated approximately 90 percent of all accidents to investigate fact finding and submit these facts to the Board. I say that about the only difference in our investigation from the Board is that we would note - and I'm not saying the Board doesn't do this - we are interested in any deficiency we may find in the airplane; whether it is contributory to the cause of the accident or not. So if there is a deficiency in the airplane, deficiency in airmen, or our airways system or ATC, we're interested in those deficiencies in order that we can correct them and make flying even safer.

Of course, lastly, our black hat. If there's any violation of the rules, why, this is a deficiency that has to be taken care of. Questioning of witnesses. We do. The team concept with the Board, I think that many are people specialists, air carrier specialists are well qualified in the airplane and are of great assistance to the Board in questioning the crew or other flight attendants about what did occur on a particular accident.

I like Jim Childs' opening remarks about standard types of investigation. I just haven't seen a standard type yet. You think they're standard when they start out. I guess on the surface, the end result may be the same. But no two are alike. The news coverage - I always get tickled, not tickled, disgusted, like Dick, about the news coverage. Sometimes they get the story right. If it doesn't sell good copies, why they'll change it to suit themselves.

I would like to turn this back to Jim Childs now, because I know, I hope, we'll have time for a few questions and answers and then we can have lunch on schedule.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

L U N C H E O N

November 3

Speaker: David D. Thomas
Flight Safety Foundation

Washington, D. C.

LUNCHEON - November 3

Speaker: DAVID D. THOMAS, FSF

Jerry, Governor Reed, Admiral Thayer, Mr. Laurel, all members of the Society and ladies and gentlemen, I'm very delighted to be here to participate in the First International Forum of SASI. I'm very pleased to be a part of the Flight Safety Foundation and to have been able to work with Jerry to make the Flight Safety Seminar and this Forum back-to-back, so that we can have for both occasions as many representatives as we have from places other than the United States. My understanding is that on the first international seminar that Jerry arranged for the Flight Safety Foundation there were some seven people who attended; it has grown in stature, prestige, and, I think, in quality and when you look at the group that has attended the First International Forum of the Society of Air Safety Investigators, you can imagine what this will be in another twenty-three years, Jerry, when you and I will both be here to welcome them to the twenty-third international forum here. Your program, for those of you from outside the United States, today and for the past week or so, has been bombarded with election news, and today is the day when everybody's out to vote. As a matter of fact, I went by this morning, and President Nixon has said that the word "vote" is the most powerful four letter word in the English language. He turned out to be right today, because Jules Bergmann was to be your speaker. Due to the election he will not be here - he's covering it - so "vote" turned out to be such a powerful four letter word that you are missing a very excellent speaker. I know he would like to have been here and I would much rather have heard Jules myself.

There are some things I would like to say to you. I am delighted to be here. It is extremely difficult to follow Bob Serling who was our banquet speaker and George Haddaway yesterday. I am still a Texan. I had a little reverse migration. I came to Tennessee and then Virginia with some twenty or thirty other places in between but I'm still a fond lover of George Haddaway's four-alarm chili, and if you cannot eat four-alarm chili you are not a Texan. I mentioned that Carl Christenson is now at loose ends. He is not. He is still chairman of our industry advisory committee, and we are going to keep him busy now that he has more time to devote to it, so we are delighted that United Air Lines has released Carl to work more in the safety field, if that's possible, than he has in the past.

I'd like to talk a little bit about accident prevention and air safety. It's in the news every place we turn, and really it's in the news because there's no real alternative to air travel to many locations. Certainly there's not internationally, and in many locations there's very little alternative to air travel domestically, and that's true here in the United States, despite a good road system, bus system and rail system. Time demands that we use our travel so that it has become part of the warp and woof of everyone's life and I think this is why the press is as interested in it as perhaps we are. It has been particularly in the news lately with the air piracy, the hijackings. These are senseless, insane acts and are performed, in my view, by warped and evil minds who would risk the passengers. As I've said several times, we pay a great tribute to the air crews who have been able for the most part to make them unsuccessful. But that has brought a great deal of attention onto air safety and has made our job more difficult because it is indeed a safety problem.

In the profession of air safety investigators, and despite the fact that in this forum we're talking about accident investigation, let's look a moment at prevention, because accident prevention is our major role. When an accident does occur, we're successful in our role if we determine probable causes, and I put those in the plural, of this type of accident and not just the probable cause of this particular accident. And, again, we're successful only if we can make that information available for a good educational action campaign to prevent recurrence. I'd like to talk about just one phase of our operation here for a moment. We could look at any phase; if you wanted to look at most deaths, you would look at general aviation. If you wanted to look at most risk right at the moment for those who purchase tickets, you'd perhaps look at air taxis. But let's focus just for a moment on jet flight in scheduled air transportation. Now we tend to think that jet air transportation is just about ten years old; as a matter of fact, it is much older, but we did have the large influx in the last ten years. But for those of us, and George Haddaway called some of us old goats, and I'm in that category, it has been eighteen years since we had the first hull loss involving a jet aircraft. In those eighteen years, there have been a hundred fatal accidents involving jet aircraft and one hundred thirty-five jet losses. Now, of course, I'm including training accidents. Last year there were seventeen jet hull losses and thirteen fatal jet accidents. We are running now one jet hull loss about every five hundred twenty thousand flying hours and a fatal jet accident about every seven hundred thousand hours. These are raw figures, and they are worldwide. Now I don't know the total cost; I do know some people that have computed the precise cost and it isn't very important, but if you would take a cost of five million dollars per occurrence, just for the bent metal, we can see that just since we've been flying jet aircraft that we've spent anywhere from two-thirds of a billion to one billion dollars for destroyed aircraft. This doesn't count the other tremendous losses. So there's a great money value, as all of you know, in the work of accident prevention.

Now I do not intend to predict aircraft accidents in the future, but anyone, and you do not have to be a statistician, could take today's rates, the ones that I just provided, and multiply them by anyone's forecast of jet hours flown, and there are some variations but they are all in the upward direction, considerably upward, and if you'd recognize that the average price per hull loss will not be the five to eight million dollars that it has been, but will jump to about twenty million for the wide bodied jets, and thirty to forty million for the SST. As a matter of fact, the newspaper reports, and I think fairly accurately, that the four hull losses in the air piracy were around fifty million dollars. Now, if you just make a very crude forecast and take these same rates, you can see that unless we do something, we'll have an additional one hundred fifty jet hull losses in the next five years, and this will be at a cost, just for the metal, the bent aluminum and bent titanium, of about one and a half billion dollars. This is a challenge to all of us here in SASI, Flight Safety Foundation, the governments, the airlines, manufacturers, colleges, and everyone engaged in the business of air safety, to contribute to the public welfare, to prevent this occurrence on a straight-line projection.

Well, how can we help? Let's start here with ourselves as members of SASI. The first step in helping is to pass on what you know to someone else. You as professionals keep seeing accidents repeating themselves over and over again. Anybody who receives accident information, and all of you do, almost becomes ill with the repetition. This stage is set (let's stick to jets right now). We have many small airlines worldwide who are now flying piston equipment or essentially

piston equipment, making the transition to jets. Unless we help them, they will make the same mistakes their big brothers made ten years ago. And when I say "we", I mean the entire industry. Another thing we've heard throughout this session in our discussion of incidents and accidents. I think one of the mistakes we make is considering any incident an isolated occurrence. If we can make the circumstances of incidents known to others, at least operators of like equipment, or perhaps that operate in the same environment if air traffic control or airports are involved, we could help reduce the accidents. I realize that many groups are reluctant to pass on incident information for quite a few reasons. One is that they think that they are unimportant. Another is that they may think that they reflect adversely on some particular company, or they may result in a law suit, or there are too many of them. I could go on ad infinitum for inertia not to pass on incident information. I do think that it is one of the very shameful characteristics of our times, and particularly here in the United States. His is a fear, and it is an honest fear, of the ambulance-chasing legal maneuvers on the one hand, and the fear of the expose type of scare story on the other hand, by some instant expert reporters or authors. I can see no constructive benefit to the public or to safety by the, what I call, "untrue in any language" type of approach to reporting, and I am a very strong personal advocate of absolute liability and, as the insurance people say, limited absolutely type of insurance, which would remove aircraft accidents from litigation and pay those who suffer injury promptly.

This morning Don Kemp mentioned the midair collision over Brooklyn. If my recollection is correct, for the people who suffered injury in that accident, settlement was just made last year.

I also think that this fear of litigation may attempt to mask some causes of accidents. I don't think anybody does it deliberately. I know all of you in this business attempt to get directly to the truth and causes, but there is that fear there, and I would like very much to see it removed. This is a very controversial subject; there's a great deal of disagreement on it; there's some small steps taken in this direction in the automobile insurance field in Massachusetts, where now the first two thousand dollars is absolute liability. I realize that there would have to be an absolute limit on the accidents but I think that we could pay the injured, who will be paid in any event, much quicker, and we could have freer accident investigation if we could accomplish this in this particular field.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 6

November 3, 2:30 P.M.

"Conduct of Investigation
...Part II"

Moderator: B. Doyle, NTSB

Washington, D. C.

SESSION 6

"Conduct of an Investigation
...Part II"

MR. B. DOYLE, NTSB - MODERATOR

On this panel today, we're going to discuss and look into a few things that assist the investigator in his task of determining the accident and coming up with areas of accident prevention. Included would be the flight data recorders, the cockpit voice recorders, human factors techniques, aircraft simulators and their uses, and aircraft wreckage mock-up after the accident.

I'm going to dispense with the bibliography of the esteemed panel and I will introduce them one at a time as we go. Normally, we will hold back questions until the end of each presentation. However, in the case of Mr. Kelly, who is the first speaker, we will ask you to ask him any specific questions in his area of the simulators prior to going on with the rest of the program, since he may have to leave us. Mr. Kelly is group vice-president of the Singer Corporation of Singer/Link.

MR. LLOYD L. KELLY, SINGER/LINK 

I'd like to start out by paying tribute to your professional accomplishments. I'm convinced more than ever after reading a number of accident reports in the last week that it takes, indeed, a professional to spend his time studying this matter of accidents and then still climb in an airplane and ride unexcited. As a matter of fact, today in coming down we took off from New York in clear weather and pretty soon encountered clouds and about that time the pilot came on for his announcement saying that we were going to have clouds all the way to Washington, that it was raining and low ceiling and slightly foggy, but good visibility and we'd arrive on time. And I got to thinking to myself, I wonder how many people who have been involved in these accidents that you investigate, listened to similar announcements and approached their destination with the utmost of confidence.

I must confess, I lack a little of that today with my recent readings. Now, what I'd like to do if I could, is just touch a little bit on that feeling I had coming down in the airplane. You see, having read all of these reports, you couldn't help wonder, I wonder if this is one of those time when the pilot's confidence isn't going to be rewarded. And then that brought to mind something which I'm sure you know that I think is not popularly understood and that is that the matter of accident investigation is not really a historical exercise. Rather, it's an exercise in prediction so that we might be able from these accidents to tell more fully and completely what is going to happen in the ultimate termination of any particular flight. And so accident investigation, then, is a skill, a profession of forecasting, a profession of prediction. And as such, it seems to me that a simulator is a very excellent tool to be use in that process.

First of all, it's a wonderful tool for predicting adequate human performance, both by training and anticipation of performance and by testing what the man will do once he has been trained. A tool for prediction.

Secondly, it is a tool for predicting the accuracy of procedures, both in the cockpit and in terms of the navigational and control systems.

And thirdly, a simulator is a wonderful tool for predicting the adequacy for machine performance for many broad reviews of flight, especially today in the light of modern simulators. And now, inasmuch as some of you might need a little refreshing on what is a simulator, today I have only two pictures, but I wonder if I could show these now, and I would like to point out to you the two pictures of a 747 simulator such as recently has been delivered to United Airlines.

Now this is a simulator driven by digital computer. It has a reel-time digital program of the order of two thousand, which is about the size of the program that was used in our simulator for the Apollo or the lunar excursion model, for example. It has a physical accuracy in terms of the internal appearance, that is precisely about that of the aircraft as far as the crew in its interior can tell. And thirdly, it has added in that large box you see sort of superimposed on the top of the 747 a visual system that I will discuss just briefly in a moment. Underneath it, we have mounted a box on the top called the visual system, a variable anamorphic motion projector system. Underneath is a new type of motion system which introduces six degrees of freedom. The motion system is a so-called level-when-right system so that if you're even in a coordinated turn, it will be level side to side. It will pitch with climb and level off. And we are able in this to produce actual G's to move the cockpit through six degrees of freedom, and we can move it in longitude and latitude, plus and minus 48 inches in position vertically plus 39 and minus 30 in pitch and roll pitch plus 30 degrees and roll plus and minus 20.

The velocity with which it will move plus or minus 24 inches per second in longitude or latitude and plus and minus 24 inches per second in the vertical and plus and minus 15 degrees a second in roll and pitch. The acceleration in longitude and latitude is plus or minus .6 of a G, the acceleration in the vertical plus or minus 15 degrees per second squared. Now, unfortunately, only for a limited period of time.

The visual system will show you at the outer marker if the correct altitude were 1,100 feet. You can vary and have an accurate picture up to 4,400 feet and down to 1,650 feet of altitude at the outer marker. In translation, side to side you can be 1,600 feet either side of zero or the center line, and in addition, you can have 20 degrees of yaw.

Now if we could take a look at picture number 2, this will show you a closeup of the 484 vamp applied to a 707 flight simulator and over on this side, you can see the runway looking out. This is Todd A0 70 mm projection system with an anamorphic lens system that changes the apparent perspective of the projected picture over these ranges that I have talked about; and they are driven, the elements of the lens system, by the same computers that drive the motion system and does the computation for flight. So that generally, the feeling of motion is projected to be the same as one sees or reads on instruments.

I might point out that that 747 simulator is at the flying position, the floor is about 20 feet off the floor, and it takes a room with about 47 feet of clearance for it to operate fully.

Now, the point is that you have here a tool of high accuracy computation of human cues that it seems to me allows us to do these things I talked about. First of all, it seems to me it enables us to work in the field of human reactions. It operates in the field of performance of the aircraft in that we could test such a parameter and it does operate through the system of control that we have wrapped around the device.

I might read for you a paragraph from a report I have from one of our people in talking with an airline. In 1966, we investigated an accident involving high sink rates and lag in engine spool-up time with excellent results. In 1968, a 727 accident, the cause of which was to be determined to be incorrect flap and trim settings, were duplicated and simulated flap and trim settings were found to be the direct cause of the accident. Later, in another accident involving a tuck-under situation, we were able to investigate the cause that led to ultimately landing gear collapse. Various flap and engine settings were used to determine the cause of the high sink rate and the results were favorable and as a result, flap settings during particular configuration were changed. In 1969, in another accident which was assumed to be the result of an electrical system failure, all possible combinations of failure were introduced into the simulator. The result showed conclusively that the electrical system which had been blamed was indeed not the cause of the accident. However, no specific cause could be listed. In regard to another airline who says our simulator has been used a number of times to duplicate incidents that led to accidents or near accidents, approach and landing techniques had been improved as a result of this study of simulated situations. An accident involving spool decoupling could not be simulated. Now the point is that there are some things that could not be proved, particularly mechanical items. I recall reading one report where, I think the screw jack on an elevator trim system had become jammed. Well, that sort of thing, obviously, could not be explored properly with simulation. With the digital computer, with a highly accurate layout of the cockpit, with visual tools and motion tools, it seems to me that we have an opportunity now to do one thing which I'm not aware is being done. And that's this: it seems to me that we could very properly as a world, perhaps as a nation, and perhaps as an airline, perhaps as a group, be interested professionally in this question. Take a greater look at the prediction aspect of accident investigation. In our company and all of your companies, I am sure there is a thing which is called cost reduction program. That's when we want to reduce costs. There's another program we have which is called cost avoidance, where we try to look forward and determine the things that will cost us money and avoid doing them. Now, it seems to me that there is such a thing. Accident investigation is like cost reduction. But it seems to me that there isn't an accident avoidance aspect the same as there is a cost avoidance program in many companies. So, I wondered if it wouldn't be possible to consider this. Suppose we were to take crews and fly them on a highly scientifically constructed program in realistic simulated conditions hour after hour. Let's presume they fly eight hours a day, not necessarily the same crew. The simulator actually in many airlines is producing in excess of 16 hours a day of training, six days a week. I read these accident reports and I see at the end after we have had the findings, after we have established the cause, the corrective action that has been taken is often listed.

Now my point is that we could prove quite scientifically areas of potential breakdown both in terms of human fatigue and confusion in terms of the emergencies that were introduced in terms of the control systems that were being used, in terms of the cockpit arrangements and lighting that was being used, even, for example, in regard to language conflicts where you are dealing with one group in an airplane and another group on the ground, you have some problem understanding each other. Now it seemed to me a program that set out to avoid accidents by running a simulated condition with real live crews through all of the various potential problems that might be faced both in all types of aircraft because simulators for such types do exist. I think every type of airline being flown commercially and most military types, it seems to me, that once a year they might find one thing that would be the cause of avoiding an accident. In looking at some of the implied costs of these, it seems to me, one year of operation of a simulator would be quite inexpensive. They fly for about \$200 to \$500 an hour, and with all depreciation and associated costs, assuming how you keep the books. So, I'm not aware and I've inquired some of anyplace in the world where there is a vigorously designed program of investigation hour after hour to determine what will happen in these various sets of conditions, both human and machine.

So, I'd like to just suggest to you that that might be something as a professional group that you might be able to support.

Thank you very much.

SESSION 6

"Conduct of an Investigation
...Part II"



MR. M. BATES, DOUGLAS

I thought maybe Bernie was going to give me some idea of what I was supposed to talk about, but as usual, when I appear at the accident investigation, I usually don't know what I'm going to do until the investigator in charge tells me. And I guess, Bernie, what you want me to talk about is what we do at one of these things.

Well, we usually get notified by our service representative. We have one with almost every airline in the world that we do business with. So he knows about as fast as the airline and he lets us know. If I'm there, I'd leap aboard an airplane and I go, no matter where it is. I have some difficulty sometimes getting into some of the other countries. Not very often. If I do, I usually go into the airline. They're usually very happy to have somebody from the Douglas Company with them.

In our own country, for example, we get there. I attend the organization meeting. At that time, the investigator in charge asks me who we have to put on the various committees. And I tell him we got about 30,000 people we could put on them. I'm not sure they're going to do any good. You tell me what you need and we'll be happy to get it for you. And that's usually the way we work. When they find something that they need, the designer, for instance, we will get him there. It's pretty expensive for us to bring the designers of everything to an accident, so we don't intend to do that. We would bring the one we think is needed, which you think is needed. And he will do whatever you want him to do. He will not report back to the family. He will report to you people or myself, who will then in turn report to you people. We will then, after recording it with the investigator in charge, let the factory know. If there is something we should do about that at that time, we will do it. If you ask us to do something, we will do it. We will do it now, not next week, next month, we will do it now. That's what we're there for. To help you people. And we intend to stay that way. And that's my story from my manufacturer.

SESSION 6

"Conduct of an Investigation ...Part II"

MR. JAMES CHILDS, NTSB

I was asked to prepare a paper on aircraft mock-up during accident investigation or the reconstruction of the wreckage to try to make certain determinations during investigation. Now in the foreword of my paper, if you gentlemen will bear with me, I'll read some of this. It might be better that I read it than trying to relate it to you off the top of my head. This publication is intended to provide those people interested in aviation safety, and especially those involved in accident investigation, with data on aircraft mock-up an alternative or substitute method of construction to aid in the evaluation of subsequent analysis of fact. The reason I say this is an alternate method which I will present here today is because the structural mock-up has been standard of the air safety investigators for years and it's not anything new. It's always been an aid in helping to determine and clarify certain points of interest associated with structural breakup. These structural difficulties may be from fatigue, high or low energy explosions, turbulence, collision between aircraft, in-flight fire, or from a combination of all of these factors.

So the mock-up has proven its value as an investigative tool and because of its importance in solving aircraft accidents, it is imperative that everyone associated with accident investigation be familiar with this instrument and its role in the investigative process.

This report was prepared primarily to produce an alternate or substitute method of fabricating the framework to be used in structural mock-up in the airplane or selected areas of the airplane during the field phase of the investigation, however, it was felt that a review of the basic fabrication methods as employed with the example of cases beneficial to the new investigator and also give all interested persons an opportunity to compare methods so selection could be made to fit the field condition.

Most investigators are familiar with the words that I'm going to read here next, and the Investigative Manual in ICAO covers most of this. Some of this is a repeat from the ICAO Manual, so I want to give credit where credit is due. Some of it is a repeat from a publication by Mr. Clark, who is our Assistant Division Chief. I won't try to say which part is which, but I will let each of the gentlemen who has published this information pick his own from what I'm saying.

Until it comes to the alternate method which is the method that we first employed in an accident in Marion, Ohio, where a propeller came loose from an airplane and severed the fuselage. Because of the exigencies of the service at that time, we didn't have enough help or time to spend in trying to mock it up using the standard fabrication methods. So the initial wreckage examination at the site, each investigator would use a general procedure as a routine practice during this investigation to eliminate unlikely possibilities. Usually, when we go to an accident site, the structural people, our structural control specialists, usually take a pretty fast look at the wreckage and if there has been an in-flight separation, that's not much of a problem. A mid-air collision gives us a little bit of a problem because usually this is complete disintegration and there's a lot of scatter. But this separation in the air that I'm speaking of, say for

fatigue, we know immediately they will get some separation, so we're going to have a try to find the area of separation and cause of the separation. So the investigator's immediate concern at the scene is to determine if a structure failure has occurred before impact. Towards this end, his initial interest is separating his ground impact from in-flight failure. But sometimes, as you gentlemen know, that is extremely difficult, because sometimes you can have in-flight failure and it will be covered up with a subsequent ground impact, so it's imperative that this be determined as rapidly as possible before anybody else starts moving the wreckage. And in that vein, usually in our case, once the bodies are removed, we usually don't permit anybody to move the wreckage until structures group or the investigator in charge gives permission.

So I'll skip through the paper here and just read some of the items and I did bring 20 or 25 copies of this paper with associated photographs for distribution for anyone who is interested in a copy of it at the present time.

Now during reconstruction of wreckage, a lot can be learned from the study of the smears and score marks that are presented, and sometimes in detail, on the structure itself. Now a smear can be defined as a positive paint primer often transferred from one part to another -- the process of two pieces rubbing or sliding across each other. Now this sliding or rubbing action frequently occurs after an in-flight structural failure. For example, a fatal wing panel often makes such a contact with the rear portion of the fuselage or the tail section. If the wing panel had been painted with a distinctive color, it would become a defined color smears on the fuselage or the tail components. These paint smears usually pile up against protuberances such as rivet heads or skid flaps. The direction of the smear before us can generally be determined from the fact that the pile up of paint will be found on the side of the protuberances away from the direction of the applied force. Smear deposits are sometimes found in the recess slots of screws. In some cases, excess deposits are pushed out from the ends of slots and deflected over in the direction of the smearing force. If an investigator can make a preliminary determination, if he believes that the smears may contain valuable clues, he can resort to laboratory examinations which, I think most of you in the structural examination stages do more often than you do not.

Now in the reconstruction technique, I'll just skip through the paper here to this part of it. Under general remarks, the reconstruction technique is one of the most useful procedures available to the investigator for the isolation of the cause of the structural failure. By reconstruction, it is meant the assembly of various pieces of the wreckage and their relative positions before failure. Generally, this technique is employed only for specific components, such as the wing panel, tail surface or control systems, although in rare cases, it has been found necessary to reconstruct almost all of the major components. And which I use that statement, it brings to mind reconstruction that some of our investigators did on a 720 that belonged to Northwest Airlines after an accident in Florida. In my recollection, that was one of the most complete reconstructions I had ever seen and actually I didn't see it, I saw photographs of it, but it was almost a complete reconstruction of the structure itself. And of course that took days and weeks and months to do this. It's no easy task.

Now the chief difficulty in reconstructing a component such as a wing lies in the identification of various wreckage pieces. If a wing is broken into relatively few large pieces, the task is much simplified. If it is broken into a large number of small pieces, as it would be if contact speed at impact is high, the reconstruction job may be extremely difficult because of the 75ST or 7075T6, or whatever the structure is since about 1948, we're beginning to get or did get more away from 2024 or 24ST so that your 7075 or 75ST is a little more brittle and it has a tendency to break into smaller pieces.

So the standard reconstruction technique is most frequently employed at the accident scene. If you can do it at the accident scene, then your problem of relocating the wreckage or your transportation problem is much alleviated, both from the labor standpoint and the cost and also the reduction of subsequent damage to your structure as you move it from point A to point B.

This brings to mind the alternate method that I had reference to at the beginning of the talk because sometimes if you try to do a reconstruction at the scene of the accident, you will have extreme difficulty in getting lumber and especially, as you gentlemen know, in the use of plywood. Plywood comes in four by eight sheets and in all areas where accidents occur that is not an easy piece of material to get a hold of. Another thing - what if you could get a hold of the materials - sometimes it's not an easy thing to get a hold of a carpenter to cut this into the desired configuration which you desire to mock up the structure. Now the use of plywood sheets for the fuselage circumferential is satisfactory for small airframes or when speed of assembly is not a factor. Where you have maybe a little extra time on your hands, you can eventually find the lumber and find somebody to cut it for you and start assembling the pieces. Now the plywood sheets, eight by four, can be cut to form the smaller structure periphery, but when a fuselage section is 14 feet in diameter, such as a B-727, the cutting and forming becomes a very tedious process. So, even if you get the material to put this together, it becomes quite a tedious process just to cut it and have all your formed areas to fit together to build this structure. So the following information concerns an alternate method which to my knowledge had never been used prior to our experience in an investigation at the Lake Central Prop Jet Convair accident at Marion, Ohio, which we have photographs in this article to show.

Now we were faced with a questionable area in the fuselage, forward of the wing-leading edge and the decision to make a mock-up of the forward fuselage, including components from the buffet and the interior bulkheads at fuselage station 227, FS 193, and FS 176. Now the usual procedure would have been to hire carpenters to fabricate a shell approximately the exterior dimension of the airplane envelope. The estimated elapsed time expenditure for carpentry was four days with no insurance that we could get suitable lumber in that time. All of the aircraft parts were in a storage building which was adequate as far as the building site was concerned or our building site and the reconstruction is concerned, so weather was not a factor in this instance. But because of certain time elements involved in this, well, we felt that some means had to be made to expedite the work and so we found that reinforcing steel rods and steel angles were readily available and procuring manpower and a generator for welder would pose no difficulty. In fact, the more we discussed the situation, the more

reasonable it seemed to do the steel rod reconstruction than to use the plywood number. So we use the actual fabricating time for the steel rods and the assembly of this was five hours instead of the four days which was originally estimated. Now the actual time was five hours, including the floor and the chickenwire covering, so the use of one inch angles for frame rigidity and bulkhead designations permitted freer movement of personnel while they were placing these components inside the fuselage structure.

Basically, we found that using this type of construction was much easier and the material was more readily available. You could do it at the site because of the use of the portable generator for power for welding. Usually, you could get a welder mostly anyplace, but it's a lot easier to get a welder than it is a carpenter. We also did this type of a thing on a 727 mock-up after a mid-air collision in North Carolina and we did this in just about the same type of time with tremendous saving in time and we could use it right on the scene and do it immediately so that very little evidence that we were interested in was obliterated before we did the reconstruction. I do have copies of this if any of you are interested in it.

SESSION 6

"Conduct of an Investigation
...Part II"

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MR ROBERT D. RUDICH, NTSB

The Cockpit Voice Recorder as an Investigation Aid.

Some of you who are attending this meeting are from States whose aviation regulations do not as yet require the installation and operation of cockpit voice recorders on transport-category aircraft. I recognize one or two gentlemen from the Commonwealth of Australia, which antedated this country in establishing a regulatory requirement for CVRs. I am at this point constrained to say to the latter gentlemen, "Sure glad to have come aboard," and to the rest of you to whom it applies, "Come on in, the water's fine!"

It has been said for years (decades?) by frustrated aircraft accident investigators, "But why did he do that? What was the background in which that decision was made or that action taken?," and other such searching questions, unfortunately rhetorical questions when faced with a seriously or fatally injured flight crew complement. This plaint is heard less and less these days in those instances where a cockpit voice recorder has survived the accident. (More about survival later.) We are almost always provided with --- no, not necessarily the answer to the riddle of what caused the accident --- but rather what I choose to describe as the most valuable single diagnostic tool to have been developed for in-depth analysis of the entire accident-making process.

The term "valuable" has more than one context as used herein. The first and most obvious one is that it reflects the incalculable savings in lives and property achieved through the prevention of future accidents by virtue of what we learn in depth from those under current and past investigation. Another measure of value is the savings in investigative costs, both in monetary expenditure and manpower utilization, by often being able to concentrate investigative efforts along the most likely productive paths.

At this point you may be asking yourselves, "What types of information is he talking about?" The obvious answer is intra-cockpit conversation relating to the conditions affecting the flight. But that is only a part of the wealth of data available from the CVR. Such items of information as aural warning bells or horns, sounds of levers and switches being thrown, landing gear in transit, and so forth, may also be gleaned from the CVR.

Other ancillary data may be derived from the recorder, such as the rotation rate of the first stage of N_1 compressor on turbo-jet aircraft with wing- or pod-mounted engines. From this information may be derived the amount of thrust being generated. Likewise, on Rolls-Royce turbo-prop engines, shaft RPM values obtained may be translated into equivalent shaft horsepower. These raw data are obtained by comparing the frequency spectrographs made from the accident aircraft tape with those made from a tape prepared under controlled conditions in flight on another aircraft of the same type with the identical model of engines and CVR. The calibrated values derived from the test flight should, of course, cover the

complete range of conditions found on the accident tape, where practicable, although considerable interpolation or extrapolation may be validly accomplished in many cases.

This technique has not been wholly successful, however, because of the innate frequency response characteristics of the microphone/recorder combination in one manufacturer's design. As a consequence of the failure to obtain data in a recent case involving a suspected double engine failure on a twin-engine jet transport, which resulted in total loss of the aircraft, albeit without any injuries to speak of, the operator, on his own initiative, is investigating ways and means to modify his entire fleet so as to restore this capability to his voice recorder installations.

Again through independent investigation on the part of another operator, it was determined that a rough measure of indicated air speed (within plus or minus seven or eight knots) can be derived from the CVR as a function of the amplitude of the ambient noise level of the cockpit within certain frequency ranges. This technique would be employed only in the event of loss of this information from the aircraft's flight data recorder.

Thus far, this discourse has been directed toward the use of data derived solely from the cockpit area microphone, or "CAM," channel of the CVR. As you know, the CVR is a four-channel continuous loop recorder, and the other three channels are assigned variously to the headset audio circuits of the captain, the first officer and the flight engineer. In those aircraft with but a two-man flight crew, the last channel records the cabin public address system.

While its amplitude will vary from one aircraft installation to another, there generally is present on the latter three channels (and occasionally on the CAM channel as well) a continuous tone at 400 Hz. The presence of this signal is due to induction interference, caused by the less-than-perfect electronic shielding of the various leads to the CVR. The 400 Hz tone, which can readily be filtered out as an interfering sound, serves more than one useful purpose. It provides a ready reference to establish precise playback speed of the tape, since the generating source is normally held within plus or minus ½% of nominal frequency.

In translating CVR time to real-world time, the recordings of air-ground communications on the discreetly assigned CVR channels are compared with ground-based recordings along with their associated time signals. Thus we are able to establish the precise "real" time of a given point on the CVR tape, as well as the exact interval between one transmission and another recorded on the same radio channel. By measuring the elapsed time between these transmissions as reflected by the CVR (after having adjusted tape playback speed to produce the maximum 400 Hz signal amplitude at 400 Hz) we can make an instant assessment of the accuracy of the electrical generating system in respect of frequency of current.

As all of you have noted at one time or another, not every message originated at a ground-based transmitter reaches its addressee in complete and totally intelligible form. Areas of spotty radio reception, and interference from other

airborne or ground station transmissions, are but two of the adverse influences on clarity of air-ground communications. In some accident investigations, it is most important to know not only what was transmitted by the ground station (whose recording may be loud and clear of interference) but what was actually capable of being heard in the cockpit of the addressed aircraft. The converse is equally true regarding transmissions from the aircraft to ground stations. It is for this reason that we cannot downgrade the importance of the discrete channel recording of pilot, co-pilot and engineer stations.

"What is our box score in respect of survivability?" should be a question the answer to which must be of marked interest to those of you whose governments have not yet committed themselves in the regulatory sense. As the slogan of a long-since departed politician in this country stated, "Let's look at the record." Since mid-1966, when the first mandatory date for U.S. registered aircraft transpired, we have had cause to examine 147 CVRs. Of this total, 56 involved major damage to the aircraft, or fatal injuries were incurred by an occupant, or both. The magnetic recording tape survived the accident in all but four of the cases; in those four, long term exposure to fire and heat (in the order of 12 to 20 hours) caused the recording medium to be destroyed. But what is significantly more important is that we have been able to determine the causal area and/or direct our concentrated efforts in what proved ultimately to be productive channels in 22 of these 56 accident investigations as a result of information derived either solely, or in concert with the flight data recorder, from the CVR.

So much for the bright side of the picture. All has not been sweetness and light in this investigative area. Besides the frequency response characteristic problem with one model of CVR, to which I alluded earlier, we have experienced on occasion severe difficulty in producing an intelligible transcription of intra-cockpit communications because of the interfering influence of radio conversation emanating from the cockpit speakers. This conversation may not even involve the aircraft concerned; in any event, the use of these speakers by the crew, especially in the transition and terminal areas, cannot be justified by operational necessity when weighed against its deleterious effect on cockpit voice recording. This is particularly true since advent of the widespread availability of light-weight headsets and boom-type microphone headset combinations.

It was because of the interference caused by the proximity of these speakers to the cockpit area microphone in conventional installations that a knowledgeable representative of one of Boeing's 747 customers (the same person who developed the technique for determining airspeed from cockpit noise level) raised such a hue and cry that these speakers were relocated to a non-interfering position. This was accomplished without reduction of the crew's capability for aural perception of communications emanating from these speakers.

Another problem area, particularly in accidents which do not require the immediate shutdown of all electrical generating equipment, has been the erasure (not always inadvertent, although this statement is impossible to prove) of the pertinent portion of the recording because of the continued operation of the

recorder. Recognize that we have here a 30-minute loop of tape, with the recorder erasing old tape as it records anew, thus retaining in storage only the preceding 30 minutes from NOW. We have been trying, with some success, to educate the pilot population to the fact that information from these recordings can be of great personal and professional benefit to them, as opposed to the previously widely-held belief that this was another manifestation of management and government installing a "spy in the cockpit." Basic to this indoctrination is the inculcation of this group with the requirement to pull the circuit breaker of the CVR for record preservation in the event of an accident wherein electrical power is retained on the aircraft for whatever reason.

So much for the bad -- now back to the good. The CVR data have been applied, with startlingly successful results, in concert with the flight recorder readout to produce reconstructions of flights from the standpoint of the man-machine relationship. This comprises two of the three corners of the loop involved in physio-mechanical activity, and which must be examined in depth for the most effective accident prevention measures to be derived. This point cannot be overstressed, since it obviously points toward our Utopian goal of working ourselves out of business by virtue of total accident prevention.

Where do we go from here? We are actively pursuing the practicability of modifying the cockpit microphone installation so as to provide, in addition to the existing omnidirectional microphone, one or two unidirectional microphones directed toward the heads of the pilot and/or copilot. All of these microphones would time-share the CAM channel through multiplexing techniques.

This proposition, if found feasible and adopted, would assist in positive identification of the person speaking as well as provide relief from present-day cockpit speaker interference. Additionally, we have recommended to the FAA that consideration be given to requiring scheduled air taxi operators of turbine-powered aircraft of 10 or more passenger-carrying capacity to carry CVRs. No action has been forthcoming to date in this regard.

The rest is up to you who are yet uncommitted. Won't you work to join those of us who have been fortunate enough to have reaped the benefits from this magnificent tool for accident prevention?

SESSION 6

"Conduct of an Investigation
...Part II"

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MR. B. HOPPER, NTSB

This past June has brought to a close 11 years of our experience in flight data recorders in commercial aviation, and I know many of you have had experience in this area, and I've had the good fortune to work with quite a few of you during readouts. I'm sure that all of you will agree that the flight recorder has become a very useful tool in our kit bags, particularly when combined with the CVR. During these 11 years, in addition to CAB and NTSB investigations, we've had an opportunity to provide readout service to the U. S. Air Force and 15 foreign governments. There's no charge for this; you don't have to put your hand on your wallet when you come to see us.

In reviewing our case book, it shows a pretty wide variety of reasons for requesting flight recorder readouts. First and foremost being accidents and incidents. We've covered everything during landing, landing approach, in-flight turbulence cases, takeoff accidents, malfunctions of the aircraft and flight control systems, evasive action, midair collisions, bird strikes. Yesterday, I even had an opportunity to read out a barograph which one of our investigators in New York brought in from a glider. So we try anything. I think you'll be interested in seeing what this 11 years has produced.

The largest group of readouts has been in the landing or landing approach regimes of accidents and incidents. We've had 151 cases. And I might say that in 1969-70, those fiscal years, 32% of those cases were received. That 151 represents 40% of the total cases. In-flight turbulence is next, with 19% of total cases; and again, better than 30% of those occurred in the last two fiscal years. So, you can see that these two areas represent the biggest areas. All together, we've had 377 cases and 114 of those have been in the last two fiscal years. So, you can see that our cases are mounting. People are finding new uses for our readouts. New reasons. We've had, just in the first four months of this fiscal year already, 19 cases. Eight of those, or 42%, are in the landing or landing approach regime. So, you can see that this is still leading the path a long way.

We've had a total of 25 cases out of this 377 that resulted in no readouts at all. Fourteen of those were due to an actual malfunction in the recorder itself. An additional three of those were due to losing the recorder completely in water. We only had a total of eight cases out of the 377, or about 2% of the total, where we had no readout due to actual damage to the recording medium itself. To sort of break this down a little bit, I believe January of 1967, the recorders were to be moved as far aft as practical. Up to that time, they had been located in radio racks, electronics departments, wheel wells. Prior to moving the recorders aft, we had a total of 30 cases where the recorders were damaged. We lost the readouts in six of those. Since the recorders have been moved aft, we have had 27 cases of damages, but we only lost two readouts. One of those was due to a freak where the recorders were located next to the oxygen bottles and the fire that ensued reached the oxygen bottles and ate up the recorder. And I mean literally ate up the recorders. It cut a swathe down through the tape as if someone had used an acetyline cutting torch.

We have quite a few problems with the present day recorders that point up the fact that we're not getting all the information that we should be getting. Our present recorders have four basic parameters of altitude, air speed, magnetic heading and G forces for the base of time, and one of the worst bugaboos is the length of time recorded to complete a readout. It takes anywhere from three days to three weeks, depending on the condition of the tape or the amount of readout to be done, and all of the data reduction at the present time and the preparation of the data graphs was done by hand. We're working, trying to get our equipment computerized to cut down on that time. But we're going to be faced with these recorders for quite a number of years. We recently had a new rule put out through FAA that requires, by September 18, 1973, recorders with expanded parameters. Basically, these are going to have to be computerized. But right now, we have problems with time correlation between parameters. Some of you who have been active in our investigations here have run into this problem. And we really had to dig to find out why we had an apparent time discrepancy. The limited parameters that we're working with don't give us too much of a head start in trying to do aircraft performance tests.

We also have an inability to correlate our readouts with flight crew instruments; because in a lot of cases the information is not taken from those areas. We also had difficulty in time matching between the flight recorder and the voice recorder. The flight recorder knows nothing but a lapsed time. In one case, United Airlines uses a couple of unused vnaires on the tape to record microphone king or transformer king of the #1 and #2 VHF communications system. When we have this to work with, then we have a means of dovetailing with the voice recorder.

The new rule is going to provide more parameters than we have now. It's going to be effectively about 20 parameters. It's going to give us more definitive information on which to base studies, or, as Bob said, we're going to be able to get a lot more out of the two recorders when we match them together. We're going to have a considerable amount of data which will be available to initiate aircraft performance studies.

I'd like to tell you a little bit about some recent experience we had with the Alitalia accident at JFK, which was a landing accident. They were carrying on board a Duvall recorder, which is a British design, and happened to be built in this country by Air Research and the data acquisition system was designed by Air Research. We took the recorder to Air Research and got a readout on it. We had some 34 parameters. I felt like the proverbial "blind dog in the meat-house" when I saw how much data there was available from this recorder. I wasn't used to this at all. The recorder is computer compatible. It happened to be a wire for the crash reporter and they had an additional performance recorder on board which uses half-inch IBM compatible tape. All that requires is that you take the case out of the airplane with the tape, put it into the computer and you have a complete readout of any particular length of time you desire. And we had it that afternoon, after I arrived. It didn't take three days to get it. And there's something in that recorder for every group in the accident investigation team. Not just the powerplants or structures, but for everybody. This was the first time in the history of the Board that we've been able to tell the pilot what he did and when he did it.

The British and the French, as I understand, are planning to have an increased number of parameters for the Concord over and above those that will be required by our new rule. They feel that they need more definitive information in the final approach area, this being the most critical. From the figures I just quote you, from 151 cases of landing or landing approach accidents or incidents, you can see why. They are asking for, in addition to what we have for the ILS localizer and glide slope information, radio altitude and certain on-off configurations of the automatic flight control system. These things are almost imperative in these accidents.

In looking over the information that will be available in the new type recorders, we are going to get away from an awful lot of the problems associated with present day recorders. It's foreseeable that we won't even approach the physical wreckage at an accident until we've had a readout of the flight recorder and the cockpit voice recorder. Because with this type of information available, and available now, we can discuss it, we can say, "this area is out; this area is out." We can concentrate and put our time and our money where it really counts.

Thank you.

SESSION 6

"Conduct of an Investigation ...Part II"

✓ DR. ALBERT CIERBELJ, FAA

Whenever an aircraft accident occurs, investigators seem to have no qualms about digging into the weather, operating procedures, hardware, or the multitude of other impersonal factors involved in these accidents. Many are reluctant, however, to scratch below the surface in the area of human factors. It seems as though they are afraid of prying into areas that they consider private. The use of a little tact, sympathy and a professional approach will, in most instances, prevent offending persons associated with the pilot and may yield important clues as to why he took off in foul weather, or with malfunctioning equipment.

Most major fatal aircraft accidents have specialized human factors investigators on the scene. They may be from the Human Factors Branch of the NTSB, the Federal Air Surgeon's office, aviation medical examiners or representatives of the local coroner's office. The refuge is inspected, autopsies are conducted, tissues taken for alcohol and other toxicology studies, medical records are reviewed, and witnesses are interviewed. Apparently, autopsies are obtained in about 75% of fatal aircraft accidents, and toxicology examinations conducted in about 50%. We'd like to achieve 100%, but technical difficulties prevent this.

In fatal accidents not having specialized investigators, investigators at the scene must look into human factors. One aspect of human factors investigation, that in my estimation receives too little attention, is that of crash-injury correlation. This is the determination of injuries sustained by the pilot and passengers, the structures that cause these injuries and the recommended changes in design of these structures.

Non-fatal accidents and those in which there is little structural damage lend themselves best to crash injuries studies. Representatives from our protection survival laboratory at the Civil Air Medical Institute at Oklahoma City are available to conduct this study. Several logical factors also seem to be getting a minimum of attention.

Perhaps this is because considerable specialized training is required to effectively unravel and understand the mechanisms motivating human behavior. The demands made on these individuals so trained are excessive.

Then there are many who have extensive training human behavior but find difficulty in applying this training to the accident investigation situation. They prefer to operate within the shelter of the laboratory or the clinical environment. Currently, one of our Aviation Medical Examiners, who is a psychiatrist and experienced pilot and has participated in a number of accidents, was interested in conducting psychiatric autopsies in selected fatal aircraft accidents. He's busy preparing a protocol to be followed in conducting such an investigation, but I don't think he's far enough along to really utilize him, but if we do find a case in which his services are needed, I am sure you could get him to go along.

I thank you.

SESSION 6

"Conduct of an Investigation ...Part II"

MR. THOMAS COLLINS, FAA

After hearing about all these new recorders and the new parameters we're going to have available to us, I almost hesitate to go on with my program. But if you will bear with me, let's talk about the Stone Age, where we have four parameters. It will probably be this way as far as Billy is concerned for some time yet in readouts.

I would like to take you through a case that I participated in in 1962, which I found most interesting. I think you will, too, and it might acquaint you with a phenomenon which exists which you may not have thought of. The case in point was the American Airlines Flight 1 accident on March 1, 1962. To set the stage for you, basically the aircraft departed with a climbing turn after lift-off and continued in a normal climbing turn until approximately one minute had elapsed when it was observed to roll over to nearly an inverted position and go straight in. Upon reading out the flight data recorder, we noticed an unusual heading trace. The heading trace was telling us things that the observers did not see and which we knew the aircraft was not capable of doing. So, we prevailed upon the Bendix people, who provided the compass system to this aircraft, to go along with us and perform a few experiments to see what caused this oddity in the trace and to see what other lessons we might gain from such a program. I have obtained in the last few days a copy of a report which Bendix prepared on this and I have removed some of the sheets of the report which I will project on the screen, and I will take you through the procedures that we followed and explain what we were attempting to do and what we found. For your benefit, the basic report of the Bendix people is #7521-62-R6, Report of Simulation of American Airlines Flight 1. Incidentally, this was submitted to the CAB and taken in evidence as an exhibit. It is public property, should you wish to obtain a copy.

The significant thing here is to remember that as long as the gyrostabilized compass system is to be the source of information to the heading system of the flight recorders, we must keep in mind the hook-joint principle. In the classic case, let us imagine if you will, the directional gyro up to speed with its axis paralleling the longitudinal axis of the aircraft. Now, if I put this aircraft into a bank and began to turn, this is what will happen: as I progress from zero degrees around to 90, there will be a period at which time the indicated heading and what the recorder senses is going to be less than the actual heading. It reaches its maximum variation as we pass through 45 degrees and the area is washed out again as we go through 90. Then as we go from 90 to 180, the same magnitude of error exists, but it's on the positive side. It's additive. This is not in normal operation detected. We're not aware of it as we turn the aircraft. We're shooting toward some particular heading and we're going to roll out on it. As you roll out, you wash out this phenomenon anyway and you scarcely realize it exists. However, let me point out that these errors can reach in a 30 degree bank, for example, the maximum would be at the 45 degree points a little better than 23 degrees in error. I think that we ought to keep this in mind when we are

interpreting the heading from the flight recorder in those cases where we are looking to the ground track of the aircraft, particularly if there has been some wild maneuvers, such as an evasive maneuver, that might have been performed. I'd like to think whenever I look at a heading trace, I'd like to mentally insert the term "indicated" heading when I read a heading, to keep me constantly aware that what I'm looking at is not necessarily where the nose of the aircraft is pointed. And since this is the thing that will live with us in the future recorders, I thought you might be interested in seeing this little demonstration which was done some eight years ago.

Thank you.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 7

November 4, 9:00 A.M.

**"Accident Reports...Development
and Use, Collection, Recording,
Retrieval and Dissemination"**

Moderator: M. Hollowell, NTSB

Washington, D. C.

SESSION 7

"Accident Reports...Development and Use, Collection, Recording, Retrieval and Dissemination"

MR. M. HOLLOWELL, NTSB - MODERATOR

Good morning. In the last couple of days, we have heard two words many times: incident and computer. We will comment on both during our discussions today. We would like to leave one statistic with you before I begin. Do you know the number of identifiable accidents and incidents that originate annually between the FAA and the NTSB? We've bounced the incident around many times and accident. Does anyone have any idea of what that is. By identifiable I mean it's on a piece of paper, it's documented, you can feel it and you can look at it. If you're interested in this statistic, it's 126,000 occurrences. Of these, 5,000 are accidents.

We are all aware of the accident record and we've talked considerably about accident, incident investigation. What will we do with the results of the investigation? That's a good question. Many agencies and organizations have accident investigation data banks, some automated and some that are not automated, depending on your need and the volume of information that you want. There are automated data banks available today that will afford you the opportunity of examining data in practically any format, depending on your needs.

I'm going to ask you to please keep the following in mind while the panel is covering our subject, Coding, Storage, and Retrieval of Accident Information. And in this case, they're talking about aircraft accident information only. That's the only mode that I'm associated with at the present time. But please keep these things in mind, and these are some of the most misunderstood items I think that there are associated with automation.

It is not practical to attempt to code everything for storage in a computer. If it isn't in the accident report, it can't be put into the computer. Not all people don't know this, but it has to be in the accident report before we can put it into the computer. The computer is not a push-button affair. In evidence of that, some of you that have known me for any period of years, my hair has turned white. It is not a push-button affair.

There are problems in the area of compatibility. We've heard the word compatibility, categorizations, indexing in the last few days. There is a big problem in the area of compatibility. Improvements are being made daily in this area. I work, during the course of a day, with people ranging from the director, the division chief, visitors of local and foreign countries, in the branch that I'm in, computer engineers, systems analysts, and computer programmers. And I asked one of the better known systems analysts one day what the problem was as far as compatibility goes. We talk about it, but no one seems interested in doing anything about it. His answer was that that is job security, so that may be one reason for not having compatibility.

The computer is not a mind reader. So, when you're listening to the people here talk about computers, data banks and this type of thing, it is not a mind reader.

There is always room for improvement in any system. To keep up with the state of the art, we have to continuously review the system, take a look at, modify it, and when you modify one code, you have to modify the code banks. So, it involves everything from the accident site all the way through to the computer program.

And the two final points before the first speaker. With the most sophisticated analysis by a computer, it needs your help in the final analysis. I know of no report, program, table or anything that we can produce in any mode of transportation coming off of a computer that doesn't have to go to some human being to take an additional look and do something with it. So, it will not take over your jobs.

The last item. Don't be trapped into a lack of compatibility between an automated system and of people intended to be the users. This is a very important area. You can very easily get ahead of yourself.

Following the last speaker, I would like to make a few closing comments. Our first speaker will be Mr. Russell Watts, ICAO representative. And he will be talking to us about what ICAO is doing in the role of accident prevention. I read his paper very carefully. I think it's very interesting. It has some excellent points, and please make note of his comment when he makes reference to what happened, where it happened, and why it happened.

Mr. Watts...

SESSION 7

"Accident Reports...Development and Use, Collection, Recording, Retrieval and Dissemination"

MR. R. H. WATTS, ICAO

Accident Reports - the task which most investigators approach with the minimum of enthusiasm; the task which is often delayed almost indefinitely; the task which is not always fully understood; and the report when it is produced is rarely used to its full advantage to assist in future accident investigation and accident prevention.

The attitude of investigators towards compiling reports is extremely important. An aircraft accident is a startling and shocking occurrence. There is intensive interest in it for a brief time and then it fades from the memories of most individuals concerned until little remains other than the facts recorded in the report. Although an investigator may pursue all the practical elements of an investigation with energy, patience and imagination and arrive at an explanation which appears to him to be satisfactory, and possibly to his superiors, the task is not finished until all the evidence which has enabled the investigator to arrive at a rational explanation of the accident is fully recorded. It is impossible to overstress the importance of recording properly all the facts that come to light during an investigation. The report prepared by the investigator should set out a complete record of the whole of the investigation and the investigator should be mindful that unless the report is properly constructed and written in clear and simple language, it may fail to explain, and in fact, may even detract from an otherwise efficient investigation.

From the ICAO point of view we are interested in two types of report, the first of which is Notification and the second a Summary of the Accident Report. Both these aspects are contained in Annex 13, Aircraft Accident Inquiry, but in the past the emphasis of ICAO work in the accident field has been directed towards the Summary of the Accident Report.

As you are aware, the majority of accident reports received by ICAO are reproduced in an Aircraft Accident Digest but one has to face the fact that, at the present time, these are little more than a partial documentation of history published some four years after the events. In my view, this is not making the best use, at an international level, of information available for accident prevention - accident prevention being the whole basis for accident investigation. Apart from the current time lag, which theoretically could be reduced to about two years*, the last complete Digests published (i.e. all three volumes) contained 49 of the 51 accident reports received by ICAO during 1965, whereas there were some 215 accidents involving public air transport revenue flights for that year. There were also numerous accidents which occurred outside public air transport operations - hence my reference to partial documentation.

*A study over a period of seven years indicated that 42% of reports were released between 1 and 6 months after the date of the accident, 45% between 6 and 12 months after; 10% more than 12 months after, and 3% more than 2 years after. Thus, if these reports were forwarded to ICAO promptly, 87% of them would have been received some 12 months after an accident, with this figure increasing to 95% over two years.

What is ICAO doing to fulfil a more useful role in accident prevention?

Firstly, far more emphasis is being placed on Subsequent Notification. Annex 13 calls for such notification to be forwarded to ICAO within 30 days of the date of occurrence of an accident. It should contain advice of the factual information available to the investigator: it is not intended that relevant information should only be included after it has been proven beyond all doubt for it is recognized that later investigation may reveal that some aspects of the information contained in the Subsequent Notification may require amendment. It is intended that it will contain all known relevant facts, and apparent facts, with the intention of conveying "what happened": if it is possible to state "how it happened" and/or "why it happened," it is desirable that this information be included.

This change of emphasis has resulted in some 240 notifications being received during the first 10 months of 1970 as against a total of 54 notifications for the years 1967-68-69. Provision exists for the immediate distribution by ICAO of any Subsequent Notification deemed to be highly significant to safety. However, generally, the notifications are disseminated by ICAO on a monthly basis, the intention being to keep States informed of the current accident situation throughout the ICAO world. If any State then wishes to obtain additional information concerning an occurrence, the authorities can contact the State conducting the investigation.

It is also significant that for the past twelve months ICAO has been encouraging States to submit advice of all accidents and pertinent incidents involving multi-engined aircraft with an approved maximum permissible all-up-weight in excess of 2,268 kg (5,000 lb.) regardless of the type of operation. This involves turbo-jet aircraft such as Cessna Citation, Falcon 10, Lear Jet, BH-200, Commodore Jet 1121, Sabreliner, Piaggio PD 808, SN-600, Searingen SA-28T, turbo-prop aircraft such as the Hawk Commander, Hironnelle, King Air, Jetstream, Mooney MU-2G, Merlin 2B, Twin Otter, Skyvan, and numerous piston-engined aircraft such as the Britten Norman Islander, Cessna 411, Piper Navajo; all these aircraft being involved in commercial operations and predominantly in the third level or commuter type airline operations. It is considered that this type of aircraft, and the operations in which they are utilized are of equal significance in aviation as the larger aircraft. Further, we are obtaining an increase in occurrence numbers; this is important in statistical processes as the operation of the sophisticated twin-engined aircraft is often compatible with that of the larger aircraft. More important, however, is the fact that we are endeavouring to look at aviation as a whole with a view to utilizing information for accident prevention over as broad a field as practicable.

Whilst the prime aspect is for ICAO to promote the exchange of such information, it is apparent that a wealth of information is now readily available to the ICAO Secretariat, and arrangements have been made for the classification, coding, and statistical analysis of this information.

It is intended to produce a Digest of Aircraft Accident Statistics, on an annual basis, which will contain a broad statistical analysis of the available data, together with brief reports of each accident. The aim is to publish this

document during the fourth quarter of each year for the preceding calendar year. The inclusion of abbreviated reports of all accidents will permit correlation with the statistics, and it will achieve regular and reasonably rapid dissemination of all accident report information. As I indicated previously, this is not being achieved at the present time.

Within the Secretariat there will be a periodic monitoring of the data to ascertain the development of any trends; and ad hoc operational studies will be carried out; and any significant results will be presented to the Air Navigation Commission. Also, at least once per annum, a complete operational analysis of the data will be undertaken and an assessment will be presented to the Commission. If, after review by the Commission, these studies are considered to contain material significant to accident prevention, the relevant aspects may be referred to States and Organizations. It should be noted that it is not the intention of ICAO to create and operate an aircraft accident statistical system such as is operated by some States and contemplated by others. An example of the type of study we have in mind would be the papers recently dispatched to States and certain International Organizations concerning landing phase accidents. We anticipate, however, that in the future we will have better statistical data with which to work.

Because of the various changes associated with the dissemination of information - in particular the fact that "brief" reports of all accidents will be published - the Aircraft Accident Digest will also be changed. Over recent years it has been published as one Digest per year but in three volumes. Volumes I and III have contained reports for a particular year and Volume II has contained a mixture of reports. Digest No. 18, which relates primarily to 1966 accidents and which is currently in production, will be the last of the three-volume format. Digest No. 19 will be one volume of selected accidents since 1966 from the backlog of reports in ICAO - this Digest is now being prepared.

A Digest will then be published three to four times a year, each issue consisting of specially selected reports of accident investigations, together with educational material relating to safety. The basis of selection will be:

- (i) technical interest to States;
- (ii) impact on the promotion of safety; and
- (iii) value in respect of accident investigation and/or prevention.

The foregoing is both a brief and broad resume of the more pertinent changes in the ICAO field. The present system of notification and reporting to ICAO relies heavily on the goodwill and co-operation of States and the recent increase in the number of notifications is welcomed by the Secretariat. However, the analysis of the data will only be meaningful if it is representative of the majority of aircraft operations. Accidents, individually, may not be of exceptional interest in the promotion of aviation safety, but information concerning them, when included in an overall review, may be significant in reaching meaningful conclusions. This is one reason why ICAO has been encouraging the submission of reports for aircraft engaged in domestic operations and why ICAO has been encouraging reports for multi-engined aircraft such as those used in third level airline commuter services or business aviation.

In my view, for accident prevention programs within States to be effective, there is a need to develop exchange of information relating to all aircraft accidents; there is a need to develop standardization and exchange of "measurement" statistics - in this regard I draw your attention to the current, and proposed, ICAO statistical reporting requirements relating to hours flown and number of landings: the information which is available, and which is proposed, has limited value for accident prevention purposes.

There is a need to inter-relate existing incident systems with accident statistical systems, and there is a need to review the possibility of international exchange of operational type incident information.

Lastly, and by no means least, there is the need to develop the use of recorded accident information as another tool for the investigator in any current accident investigation. Now that computer development permits rapid retrieval and comparison of data, proper programming and classification of data could assist an investigator before proceeding to, and during the course of an investigation.

In considering any future development, it should be clearly understood that I do not see ICAO's role as one of maintaining an international data bank or computer center. I believe it is ICAO's role to promote standardization of procedures and practices, thereby creating one "pool" of information maintained by the various States: to encourage States to utilize this "pool" for their own research; for ICAO to utilize this "pool" of information, and for ICAO to ensure that there is proper and adequate dissemination of information.

SESSION 7

"Accident Reports...Development and Use, Collection, Recording, Retrieval and Dissemination"

MR. DAVID KELLEY, NTSB

Good morning, gentlemen. Let me say at the outset that my remarks pertaining to a computer system of storage retrieval and dissemination of aircraft accident information pertain or relate to the system presently being used by the National Transportation Safety Board.

The Safety Board has a system. It works; it's been in operation since 1964. We've been recording occurrences in U.S. civil aviation, commencing with those that happened in the calendar year 1964, and every subsequent year. The system has the capability of recording accidents and incidents - air carrier, general aviation, rotocraft, fixed wing - it doesn't make any difference. It has the capability of recording preliminary accident reports, and then when the subsequent final report comes in, the final report deletes the preliminary report from the data file. At the rate of 5,000 accidents occurring annually, at the present time, we have some 40,000 occurrences stored in our data banks. And you can classify that as massive accident data.

Let me echo the remarks of Russell Watts on Monday concerning the international exchange of accident information. We are very pleased to have worked during the last several years with the government of Australia, who in turn, took our systems and programs. And with certain modifications oriented to their needs, have implemented and are using that system today in Australia.

In addition to that, we have recently implemented a program where we exchange historical files containing accident information. In other words, we mailed to Australia a tape that has the accidents and incidents on it according to the United States; and they in turn, mail back to us similar data representing those occurrences happening in Australia. So you see, the talk about exchanging accident information at the international level is in fact being done at the present time.

Let me move on now to an area we'd like to talk about: data collection or fact finding. Quite often, we get the question, what kind of data do you need? What kind of data do you want to come in to be put in the data bank? We try and answer that question two-fold. First of all, we have a need to receive the data from which the Board - the National Transportation Safety Board - can determine the facts, conditions, the circumstances and the probable cause relating to the occurrence. Additionally, we want to get the information into our data bank, from which the Board can promote aviation safety. Now, that's a pretty big mouthful, aviation safety.

Let me literally translate it for you. The reduction and prevention of accidents. I'd like to address myself a little bit later, as far as data dissemination goes, to achieve that particular objective.

Another question asked, is, how much data do you need? Well, let me just answer that. I'll give you both ends of the spectrum as to how much information

or data is necessary in the data bank. On the one end, if a particular specific item of information relating to the accident is not reported by the investigator, it will never end up in the data bank. You will never be able to come to me and ask me to make a statistical run to get an answer pertaining to that item of information.

On the other end of the spectrum. Quite obviously, you can't report and record every conceivable item of information pertaining to an accident. There has got to be an effective limit to the amount of data that you can manage.

So, in effect, we have requirements that are changing. Changing requirements as to the data that is necessary. Periodically, you should take a look at the data you have stored. If it's not being utilized, delete the requirement that required that information to be recorded. Add new requirements. You have new aircraft coming out, you have stability augmentation on it, you have new facilities in use, such as groove runways, category 2, minimum weather landing. These are the types of information people are now asking about. Make a requirement that those kinds of information be recorded.

So, in effect, we end up. We have the federal investigator as a result of his on-the-scene investigation or desk audit, complete and standardized reports, a factual report of investigation. We also ask the pilot, owner, operator involved in the accident to fill out a report on the investigation. You put these two reports together with witness's statements, ATC package, photographs, autopsy, pathology, etc. This forms the accident package. The accident package is forwarded to Headquarters, or in our case, to Washington, D. C.

What happens when that accident package gets to Washington? Well, that accident package goes to a group of technicians. And I say technicians, not clerical people. These technicians are aviation qualified just the same as the investigator in the field. These technicians analyze the data, and extract information, glean information from this accident package and they fill out or they code what we call a source document or an analysis sheet. This analysis sheet is then forwarded for keypunch and you end up with a product. You have got a series of IBM cards and you are now ready to implement this data or this information into your computer system. We do this, utilizing what we call an up-date program. To add the new records to our data file.

This same program, as I referred earlier, is the program that when the final accident report comes in and is recorded, it in turn deletes the preliminary report that was put on initially. So you see, we have a fluid or flexible file, including preliminary and then final accident reports.

An additional by-product of the up-date program is what we call an edit program. It takes a look at the data which has been keypunched, identifies the invalid quoted data, incorrective keypunch data, which we in turn refer back to the technician for review. He writes corrections and we come back and correct the file and up-date the file again.

So, now let's assume that we have a file of information containing aviation occurrences that's technically accurate. It has been reviewed, refined and corrected. It's up-dated. We'll call it a clean file. Clean file date. It's

inherent upon us to have the capability to retrieve this information, to look at it, to compare it and to manipulate the data. We do this through the utilization of a series of computer programs. I'm not going to get into a detailed explanation of all these computer programs and what they do. It probably would take all day. Suffice to say, they ask questions, you get answers, it tabulates causes and factors, it tabulates injuries, it compares accident data in an xy matrix, etc.

Now, let me move on to the area of data dissemination. This probably is our most important facet of the total project. To put this information to use, to reach our objectives, as I said at the outset, the promotion of aviation safety, or the reduction or the prevention of aircraft accidents. Well, how do you do it?

We like to get the right data, put it in the right format, give it to the right person and/or agency who in turn can do something with it. Do something with it to stop accidents.

Let me briefly go over with some of the users that we have, some of the people that use our data as far as dissemination and promotion of aviation safety. I'll start with the Board itself. We try and retrieve and present aircraft accident information to help the investigator, whether it be a catastrophic or a major accident investigation or a fatal field investigated accident. We try and retrieve data pertaining to the particular airline, the particular aircraft that's involved, the particular set of circumstances to give the accident experience to that investigator even before he goes out to the scene of the investigation. We try and retrieve data in statistical support of safety recommendations that the Board forwards to many addressees. We put out recurrent publications, such as annual publications, and accident information relating to general aviation, to air carrier, information pertaining to specific makes and models of aircraft, briefs and accidents on civil aviation. We try and do in-depth statistical studies on various segments of the aviation community, such as air taxing, corporate, executive, or types of accidents such as midair collisions. We provide information to other government agencies such as the FAA, in support, for example, in a notice of proposed rule making. To NASA to support flight test work such as a recent project they worked on - the general aviation aircraft handling qualities project. To the Department of Defense and individual services most normally in relation to a specific accident that they're involved in. We have a similar type of aircraft flying in Civil Service. Quite often they come to us and ask us for the accident experience in Civil Service. The Weather Bureau. Information pertaining to clear turbulence, weather forecasting, etc. We try to provide information to aircraft manufacturers, aircraft component manufacturers in hopes to be put to use in future design work, in future production work. Finally, we provide information to those in the aviation community that have a need, an interest, in the promotion of aviation safety. Such organizations as the Flight Safety Foundation, Air Transport Association, Airline Pilots Association, AOPA, etc.

Now the overall theme or the thrust of the utilization of this information has got to be that we take a look at a segment of aviation, whether it be kind of flying, the type of aircraft, a particular type of pilot. Take a look at the accident experience, what has happened, identify their problems in that particular area and then in turn seek solutions, forward recommendations, try and get remedial action.

No system is perfect or complete. We're certainly aware of that. We're constantly striving to add to and supplement this system to be more responsive toward the goal of aviation safety.

I'd like to briefly review some of the civil areas that we're presently working on to add to, to supplement our system. We have an on-going project, which we hope will establish the capability of a series of high-level statistical tables from which we will be able to compare and analyze in depth the 30,000 occurrences we now have stored. The present capability we have is only a manual comparison. We're looking for high-level statistical comparisons. We also have an on-going program in which we're going to automate the safety recommendation process as it's related to the Board.

We're thinking very seriously and looking at the system of cost and analysis of a dollar value associated with aircraft accidents. We want to assign a dollar value to the aircraft loss and in turn have some feel of the impact that aircraft accidents have on the economy.

Before the end of this calendar year, we hope and plan to install a remote job entry terminal in the physical quarters of the Bureau of Aviation Safety. This is a piece of hardware that's connected directly to the computer, the main computer complex, via telephone leased lines. It will give us the capability of submitting jobs directly to the computer complex and receiving outputs back from the physical quarters of the Bureau. We greatly hope that this will increase and make possible to receive data, receive answers a great deal faster than we have at the present time.

And just as a little food for thought, you might think about the day someday down the road when we have a terminal of this kind in every one of our field offices and we have the capability of implementing accident data directly from the investigator into the computer.

One final area that we are looking at is the so-called human factors involvement in aircraft accidents or the underlying pilot causes, plus the psychological and physiological causes associated with the pilot. We're working on this area. It's a very difficult area as far as qualifications of people who can make these assessments, the factual information we would need to substantiate this type of information.

Thank you very much.

SESSION 7

"Accident Reports...Development
and Use, Collection, Recording,
Retrieval and Dissemination"

MR. JOHN CARROLL, NTSB

I'm really honored to be here before the world's most knowledgeable group in accident prevention. I've been asked to speak to you today about this program that we've started to automate the recommendation.

After Dave Thomas's most appropriate remark yesterday where he stated that the most valuable accident prevention tool we could have would be a perfect knowledge of accidents and then be able to pass on the information. I believe that this program, which is one of some 38 in our accident prevention program, will be one of the most worthwhile. While there's a great deal of information that we do not have, there is a vast depository of data on hand that's literally going to waste. I won't dwell upon the lack of resources or lack of personnel or lack of technical know-how that keeps us from putting these data to work for us, but I will acknowledge the lack of emphasis placed on the use of existing information. Right now we have two beautiful stewardesses visiting with us at the Safety Board from AOPA headquarters who are poring over ten years of full dockets, the full accident reports on air carrier accidents to identify the recorded hinderances to emergency escape and the causes of disablement of cabin attendants during emergencies. They assure me that all the facts are there. They just haven't been used, but I think they will be now.

I'm sure that most of you have heard the old story relating to the getting of facts but not necessarily the information. George Clark and Glen Bruno were down in Texas a few years back flying a free balloon. They got caught up a little bit longer than they had expected. It got dark and that morning at daylight they floated across some Texas farm country and had a few questions to ask but no one to ask them of. Like, "Where are we?" They did see a farmer down there on one of those Texas farms. Glen said to George, "Here's our chance. We'll find out where we are now." When they got within shouting range, George shouted down to the farmer, "Hey, where are we?" The farmer looked back up and he said, "You're up there." Glen said, "Look, George, maybe that wasn't the right way to ask the question. Let's put it another way." And Glen leans over the side of the free balloon basket and shouts down, "Where are you?" The farmer says, "I'm down here." In both cases George and Glen got the facts but not necessarily the information. This is typical of a situation that exists right now that's been designed to give the information that the Board needs in a situation where we delegate the accident investigation to another agency. The Board gets the facts and the circumstances and the conditions, but not always the benefit of the investigator's experienced findings or his opinions. We get the facts, but what about the information. In our philosophical system of checks and balances, perhaps we have a statistical washout that will always yield the objective overall findings, but I personally doubt it.

I'm convinced that the NTSB data bank is the most thorough, the most extensive, the most appropriate accident data system in the world. As Moe and Dave have already said, it doesn't mean there's no room for improvement; merely that we are not continually striving to keep up-dated.

Based upon this accident data system, we hope now to go several steps further, to keep track of remedial actions. Over the years, there has been a tendency to make our recommendations and letting some of them fall into and get lost in a bag of feathers. And if George Wansbeek were here, I would explain the bag of feathers. He's always complaining about our colloquialisms. What I'm saying is that we have investigated accidents to determine the cause and made recommendations and if the recommendations were implemented or they just sort of drifted away and we went on to the next investigation, we were not always assured that what was recommended and what was accepted as a good recommendation was ever really thoroughly followed through. We propose now to classify, code, file and store and this would assure a better followup action. More than that, this should assure recall and use of past experience for present applications and particularly for justification of current recommended remedial action.

But most important, I think this is going to lead us to a development of a technique where we'll be able to project trends, a trend analysis situation, that we've looked at and we need and just don't have.

Let me give you one example. In 1948, or thereabouts, spin training was eliminated as a requirement for pilot qualification. Among the reasons given at that time for this amendment was that too many accidents and injuries were occurring due to this spin training part of pilot qualification. And that it was proposed that this amendment would encourage the manufacturer to build more stall-resistant and stall-proof airplanes. We know that did not happen. And as this new breed of non-spinning pilots swelled the ranks of the civil pilot community, the numbers of recommendations from many of our old-timers here today asking reinstatement of spin training grew and grew. But reasons such as the aircraft is plaquered that it is prohibited from intentional spins and other reasons, such as the pilot should have known better than to have gotten into that situation, caused continual rejection of the air safety investigator's recommendation. Years of repeated rejection have caused the same air safety investigators to shy away from a now-proven sure way to fail with a recommended remedial action.

Coupled with our proposed automated recommendation process, we intend to try to help alleviate the situation by asking two good questions of each principal investigator during each investigation. These two questions are perhaps the key to being able to get back to the basic information that we need although we have the facts. Questions are, number 1, "What would have prevented this accident?" It's great to have all of the accident data, all of the information, the forms completed and the data banks swelled with all kinds of information to retrieve, but what about the question, "What would have prevented this accident?"

The second question, "What could be recommended to prevent this kind of accident from happening again?" Not, what do you recommend, but what could be recommended to prevent this kind of accident from happening? Providing the answers to these very direct questions will not relieve the investigator of his responsibility to propose and justify as best as he can the formal recommendation arising from his investigation.

Our target for implementing this program as a new investigative tool is January of next year, 1971. I hope that we will be able to report early results of the beginning of this program at the Second International SASI Meeting.

Thank you.

SESSION 7

"Accident Reports...Development and Use, Collection, Recording, Retrieval and Dissemination"

MR. J. RALPH HORN, FAA

Good morning, gentlemen.

You probably noticed I came in a few minutes late and therein lies a bit of a story which I think is appropriate seeing that our subject for all of these meetings is safety. Any of you who have ridden with a cab driver in the Washington atmosphere, you usually brace yourself for a series of events and hope that none of them get out of the incident category and into the accident category. Well, there's one in Washington so careful that I expected him to read the rule book before every move, such as pulling away from a traffic light. In fact, he was so safety addicted that he was a traffic hazard. I could have walked over almost as fast as I got over here in the cab this morning. So maybe that was a pretty good lesson. He'll never run into anyone or run over them. He may get hit himself, or cause accidents, but, boy, he followed the rule book like I was the chief hack inspector sitting back there ready with a ticket to hand him. So that explains that little episode.

Before we get off too far here, we've been talking about computers and whether we like to believe it or not, we keep bumping into the situation every so often that we've sold these things so well, that people are beginning to think they can rationalize things for you, make judgement and you name it. And even though Moe has pointed out earlier that you cannot walk up to it and push a button and get a response. It's not that easy. But nevertheless, there was this salesman from one of the big computer companies and he had been working for quite some period of time with the purchasing agent and other executives of this large corporation and he felt he was getting closer to that final day when he'd get the signature on the dotted line. In fact, he was so sure that this morning he had an appointment with the president of the company and he just knew this was the time. So, boy, he really polished his pitch and he went through it perfect and he had the demonstrating machine all warmed up in case the president wanted to see something happen. Well, he got so enthused with himself that he proposed that this machine was almost human. It could almost think. Not quite, but almost. So he said why don't you ask it a question. So the president of the company thought a moment and he said, "Fine, ask the machine where is my father." So he told the machine in computer language and the lights flashed and the bells rang and in a few minutes it pumped out a card and he pulled it out and read it and said, "Your father's in Canada fishing." The man looked at it and said, "Gee, buddy, you got a wonderful gadget there, but that can't be. My father's been dead for years." Gee, he thought, well this calls for a little bit of ingenuity. He said you know sometimes they don't quite interpret things like we do. Let's ask it the same question in a different vein. Let's ask it where is the man who married your mother. So they did, and the same things happened; the bells rang and the lights flashed and the first thing you know, it printed out a card and he looked at it and he had a smile all over his face as he handed it to the man and it

read, "Your father is in heaven." The man says that's right. He's been dead for years. About that time the machine started running again and it printed out the card, he snatched it up and it said, "But I still think your father, your real father, is in Canada fishing." So let that be a lesson to us that we don't always get what we expect. Now at the risk of being just a little bit repetitious, but as our friends here have told you earlier, we, too, have a data system over at the FAA. Our purpose is a little bit different than that of the people in the NTSB. We need this data as early as possible. In fact, the whole reason for collecting it is safety and safety means prevention. We can't wait until everything has settled down and dust has drifted away from the scene of the occurrence and the data collected and it's been taken back and looked over and discussed and generally given a good going over before something happens. So we need to approach it just a little bit different and while there are areas where you would find it difficult to figure out who was the NTSB man and who was the FAA man, there is a difference. We don't always quite get it straightened out sometimes, but it's there. Let's start from the notification. When there is a notification of an accident, or an occurrence, let's put it that way, because we get many notifications that turn out not to be accidents, but they have a safety value. We want to know about it immediately, long before the official investigation is complete and before it gets into the computer system. Knowing the information early could be very important and it will come to us by teletype or telephone. A distribution system assures that affected segments of the agency are notified and in this way it tells somebody at headquarters, "Let's take a look at this." Here's where we make use of our stored data. They'll take a look and see that maybe this is an area in which we're getting too many of this type occurrence and that immediately starts a follow-up action that may be well on the way to corrective action before the accident investigators get too well organized on the scene of the accident.

We think of safety in many ways, but, with few exceptions, the FAR's are included to some degree; the individual airman is inclined to think of their application in terms that apply to his immediate problem or certification specialty. However, headquarters cannot stop at this point and complete scanning of the regulations may be called for, testing to see if maybe the regulation itself is not of the best. Perhaps, through advancement, the state of the art and what the regulation provides for are no longer compatible or maybe we have discovered a weakness that needs to have some loophole plugged. So when we get this notification, this starts the machinery in motion and our man in the field keeps reporting. If it's a catastrophic type accident, we have a man from Washington headquarters go out and that's his one and only job - keeping headquarters advised, informed and sort of a go-between to make sure that the important information as it is discovered is transmitted immediately to keep these wheels turning that are trying to grind out and keep ahead of events as they are developed at the scene of investigation. I won't go into all of the gymnastics of the reporting, which is a little bit different than what you get in the NTSB, but I will say that when the final report comes in, it is processed similar to that of our NTSB friends. We are limited, though, we cannot come up with a probable cause. But that doesn't delete or even dilute our effectiveness at all. There are many safety items that are uncovered in the most simple accident that may not ever figure in the probable cause. And such things as the behavior of the pilot, maybe it wasn't of sufficient magnitude that would say it was pilot error, but it might excite you to go back and trace back in this pilot's training, who was his instructor, what school, what has been his background.

You may find that he had the best of instruction but he is just the type that goes out on his own and ignores it. Or you may find that he was doing absolutely the best he could with the information he had, and his instructor or someone had dropped the ball.

So these are the areas that we are looking into. And, eventually, those will tell us what the probable cause is, but these areas sometimes get shoved to the side so deep that they're hard to uncover. If you wait too long and they get diluted, it's hard to find them. So we get all those right away without waiting for the official report.

There are very few accidents in the general aviation field that do not show some sort of correction action or remedial action having been taken on the spot or immediately thereafter by the investigating inspector. It may only be in the simplest terms - a conversation, a verbal discussion with the pilot; it may be with the pilot and his instructor, his employer, etc. It may take the form of an enforcement action. If it is severe enough, the enforcement action is taken immediately through the powers of emergency suspension. These are all under the category of promoting safety. If you delay the action for months for the official findings, the effect of any corrective action has been lost and in the meantime you may also lose a couple of aircraft or a couple of our pilots.

So that sort of gives us an overview of where our responsibilities lie, what we do and how we go about doing it. Now there's much more detail than I could possibly cover here today, but this gives you a little idea of what is going on in our field.

Along with this investigation, when it's completed, our man makes a distribution of the report in a manner prescribed for him and among other things, without going into detail, it goes back to the region that has the certificate responsibility for that aircraft. The engineering people back there look this over to see if there is something there that has begun to show up as a mark of weakness or some characteristic that they maybe should go to the manufacturer and talk about these conditions. The report goes back to the district of the pilot's residence when the accident occurred outside of the district where he lives. This gives the inspector in that district office an opportunity to go out and investigate a little bit farther. He's not investigating the accident; he's looking into why did these things happen. He may have information of his own that tells him that a particular school for some reason has an unusually high number of their people having accidents. This gives him something to go by. Each little piece doesn't in itself prove to be a problem, but if put together in a proper sequence, it will eventually give him the information and materials that he needs to go out to these people, make suggestions of correction/remedial action they may take and if he finds that they're not responsive to his suggestions, then he has to go a different route, unfortunately, in many cases taking forceful action. But this is all part of the problem and why we get into this business of safety.

Not all, but many of these corrective/preventive actions should be backed up by additional information. In other words, one occurrence doesn't necessarily mean you should go out and really get rough with somebody or you take some stringent action. That's where our data system comes in. We put this data out in various forms and we continually work with it. Needless to say, it does not point a red finger and say here's where you go to correct your situation.

It may indicate that just by casual glance, but you have to get into the data bank and give it a good going over, every particle of it, and here's where you get the data that goes out to alert people to possible weaknesses and you also have data to support the man in the field when he comes up with one of his emergency situations or a suspected emergency situation that he's got data now to back up his findings and his contemplated action.

Now, we'll go back to a moment to the data bank. We have two of them really. We have the general aviation data bank which is an automated computer type. In the field of air carriers, we have what is known as a Termatrix System. It's a manual system that's very efficient when you're dealing with small units. In the air carrier field we're dealing with not more than a hundred units per year, and this gives us ready retrieval. The information - we can get it out of there faster than they can out of a mechanized system because we don't have to write a program.

The other important facet of our work, which was touched upon earlier, is our incidents. Now, I'm not sure, but I think Dave Kelly, when he was talking of incidents, referred to those that are required by NTSB. In addition to that, we get somewhere in the vicinity of 5,000 plus incidents per year because under our requirements, our people, our operators and so forth, report anything out of the ordinary whether they really know what it's all about or not, we are asking them, sometimes requiring them, to make up what we call an incident report which is outside the scope of that required by the NTSB. Now this incident report, some of them are not worth too much really, but nevertheless, every one of them in somebody's opinion represents an item that has safety aspects and after all that's what we're in business for. The minute we get to the point that we can't say that, we're out of business.

So these incident reports, merely because of the interpretation of what constitutes an incident would have been an accident in many cases. So they become very important. Maybe for no reason that you could explain, the thing would come up as an incident, whereas a half an inch in a different direction the thing would have been an accident. So these incident reports get a lot of attention and many recommendations, safetywise, come out of there. We have a man who does nothing but review these incident reports and classifies them into occurrences having something in common, such as a particular type of occurrence after which an in depth review is made to see what can be done.

Another thing that takes place in the field of safety that's a little outside of the computer or data record keeping machinery and little publicized, is used in air carrier accident followup. If you take that aircraft, all of its parts and components, there's a list of people involved or have an interest in it, that's as long as an airplane, and they're scattered all over this country, of the various regions, there'd be something on that aircraft that involves every region, every engineer staff in that region. They have what we call a corrective action report which means simply this: The region having, say, the powerplant certification responsibility for the engine(s) installed, is required to review the information discovered in this accident investigation and send in a report whether or not their region has any responsibility in this powerplant in so far as it contributing or having any effect on the accident. This goes right down through the airplane manufacturer, systems, etc.

Now this brings in a lot of information that brings about corrective action, because here's something that showed up on this engine, as an example, that really wasn't contributory to the accident but it was discovered in the investigation. It's a rather simple thing, but brought to the manufacturer's attention by our engineering people who are responsible for it, they can take a look at it and come up with a better fix. And this is all important in these accidents where you span across regions from one coast to the other.

Well, this has been rather brief insofar as telling you what we do. We would like to have, and I'm sure I'm speaking for the rest of the people on this panel when I say this, any suggestions, comments or questions. I, for one, am certainly ready to do the very best I can to answer them and don't be like the new Minister who just got out of college and assigned to his first parish and his first sermon, he was naturally very nervous, self conscious and not his very best. But, nevertheless, he really gave it everything he had. And after the service, he was standing at the north exit of the church greeting his parishioners. As they came through the line, they congratulated him on how much they enjoyed his talk and he was beginning to feel real good. His confidence was coming back and then the first thing he knew, here come this little mousey-looking man in the line. He shook hands with him and said, "Reverend, I've heard worse sermons, but I forgot where." That really rocked him, but the next dozen or two were very complimentary of his efforts, and the first thing he knew he reached down and was shaking hands with this little fellow again, who said, "I'll say it again. I've heard worse sermons, but I forgot where." This really upset him. He didn't know what to do about this, but the next parishioner in line was equal to the task and he came up and said, "Reverend, pay no attention to this fellow here. All he does is go around repeating what he hears other people say."

Thank you.

SESSION 7

"Accident Reports...Development and Use, Collection, Recording, Retrieval and Dissemination"

MR. M. HOLLOWELL, NTSB, Closing Statement

I like Ralph's choice of words that he used, "eventually to get the probable cause out." Probably no one on the Board is criticized more than I am for being so slow. The Board is very slow and I'm sure the Board agrees with me in this case that we are slow getting the reports out. There are reasons for this, but we are guilty in that area.

The National Transportation Safety Board has a good workable, automated accident-incident system. It's intended for the promotion of safety in flight. It is not intended to be used for violations of some of the items that Ralph was pointing out to you. It's there and it's intended to be used for safety purposes. As Dave mentioned to you, it is now being used by Australia and the United States, two English speaking countries. We feel that other countries are ready to assist and we encourage this in the conversion of the system to another language.

First, I was going to say that it was perhaps thought of as one of the Romance languages. This is not necessary. I think you will find that our friends, the Japanese, in many, many areas are well advanced in this area and ahead of us. In their T.V. stations and radio stations, their automation is far ahead of ours. So it is not restricted to the Romance languages.

I am speaking of a language here other than English. I am not talking computer language. The codes are compatible; the meanings are generally accepted worldwide. We have improved definition of indexing. The word grounded can be converted to French, Spanish, Italian, Japanese. The only difference is in the spacing requirements. They are adjustable to the format that they have. We feel that this would be a major breakthrough in the exchange of accident information on the international level. You know it's working very satisfactorily between the Government of Australia and the United States. The Board will give its full support in this endeavor.

As a package, we have historical files, documentation, user instructions, and the computer programs all on one magnetic tape.

Please drop by and see us.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 8

November 4, 10:30 A.M.

"Accident Investigator and His Problems"

Moderator: Mr. Frank Yeend, Australia

Washington, D. C.

SESSION 8

"Accident Investigator and His Problems"

MR. FRANK YEEND, AUSTRALIA - MODERATOR

It is indeed an honor to be asked as the first non-American moderator to moderate this session of the Forum. We certainly have a distinguished panel in Session 8 to discuss the accident investigator and his problems. I hope that the temperature won't distract you from the interesting things that they have to say.

The first speaker we have this morning concerning the accident investigator and his problems is Sam Parsons of NTSB, which is the Washington field office at Dulles. He's also, of course, Vice President of the Society, and Sam is going to talk to you for a time this morning principally about on-the-job training.

I'll ask you if you'd keep your questions until the end after all the speakers have spoken and then we'd be pleased to have what questions you'd like to put at that time.

MR. SAM PARSONS, NTSB

Thank you, Mr. Yeend. Good morning, gentlemen.

Most remarks we've heard in the last few days have been confined mostly to air carrier accidents. There's been very little mention of the type of plan that we like to refer to as the bug-smashers and bug-jumpers and so forth, which are general aviation accidents.

As I said, I want to confine my talking mostly to general aviation, since that is where the largest portion of work comes in, at least at the Dulles field office. We have considerable participation in major accidents, air carriers, and what we call the large jets, I mean the corporate jets, but when we go out usually as individuals and meet our counterparts from the FAA, we generally go out in small planes. The Cessnas and the Pipers, and what have you.

The term "training of accident investigators" is a wide subject. It includes all phases of training, such as initial training, formal training, refresher training, on-the-job training, training for small plane accidents, major accidents, catastrophic accidents, and so forth. The training of our investigators never ceases. Even the most experienced investigators and those who have been around the longest are continually learning something new.

The old saying you can't teach an old dog new tricks has exceptions and accident investigators is one of them. New aircraft equipment, new facilities, new rules of operation, continually make demands on every investigator to add something new to his bag of tricks. However, training has its problems, no matter what the phase. Time does not permit adequate coverage of all phases, so I might talk in the area of which I'm most familiar - on-the-job training,

which is one of the missions of the NTSB field office at Dulles International Airport. We have eleven field offices, and, I believe, they chose the Washington field office as the training office because of its proximity to Washington Headquarters. There's one basic problem with this type of thing as presently established which deals with selection of the trainees. There are minor associated problems but none that can't be solved readily when they are brought to the attention of headquarters. Any other exigency that may occur, I prefer to call a challenge, not necessarily a problem. And we have several challenges.

First of all I will define the objective of our on-the-job training program. We take a man who's been selected by headquarters, as top candidate for the job of trainee and attempt to mold him into a stereotype accident investigator. Let's face it. When we mention the term "air safety investigator", we all conjure up an image of ourselves which is a highly knowledgeable and experienced investigator. So the objective of our on-the-job training is to produce a likeness of ourselves. A man who can walk onto an accident site and announce authoritatively that he is the investigator-in-charge. He proceeds to solve all problems expeditiously by his versatility of experience, supreme management capability, aero-dynamic prowess and finesse. He is able to find the probable cause of the accident with his own sense of duty to the public in both accuracy and determination at minimum of cost.

The Washington field office is allotted about one year to turn out such an investigator. We would hope that the screening process at headquarters used for the selection of trainees take into consideration, among other qualification requirements, the prospective candidate's versatility of experience, his management capability, his aero-dynamic prowess and a strong sense of inquisitiveness. If the trainee possesses these attributes, that often can be accomplished effectively in a few months. If he selected physically because he has a commercial ticket, two thousand or more hours of flying, has attended safety school, he was a safety officer in a military squadron for three or four years, he may be more difficult to train. The problem is not so much in our ability or lack of ability to teach the fundamentals of investigation in the allotted time as it is in the assurance that the selectee has the necessary attributes as well as the qualifications. Support of this contention is as follows: One, fatal general aviation accidents occur under a wide range of circumstances and locales. In all cases, the public is involved, whether it's local law enforcement officers, civil air patrol, rescue squads, news media, property owners, next of kin, foreigners, medical examiners, volunteer workers, guards, possible witnesses, or, as in most cases, on-lookers.

In addition, the FAA is representative. The approach to an accident site is by, with and through many or all of these. The trainee must learn the proper approach to those he is to work with. This has little or no relationship to his investigative ability, but it does make demands upon his savvy with people. Two, the trainee is taken to his first general aviation accident as an observer. There he is exposed to the whole process of investigation and given detailed instructions in all phases. He assists in documenting the wreckage and shown how each fact is determined with emphasis on determining the exact configuration, altitude and approximate speed of the aircraft at impact. These are important for the determination of the type of accident. At comple-

tion of the on-site investigation, the ideal trainee is invariably overwhelmed at the accident investigation process and he is highly motivated to tackle the next accident. Any other type of trainee does one of two things. Either he says there's nothing to it, he's ready to go out on his own, or he shakes his head and tells us how this stuff is really complicated. In the latter cases, our job is cut out for us and there may be much work ahead. Mostly in educating and changing attitudes. Three, on subsequent accidents, the trainee is assigned to the investigator-in-charge or as trainee investigator-in-charge, with close supervision by the instructor. He does a complete investigation and he is coached step by step for the proper performance with the reasons for each accident carefully explained to them. He is given responsibility for the third element of his training -- the accident report. This is where he is tested in what he has learned and how well he can communicate the facts and support the probable cause. If he is the ideal trainee, he does an excellent job with his first report.

The fourth element of his training is in office procedure, accident notification and learning the system involved in travel, making out itineraries, watch standby, Title 14 regulations, Federal Air Regulations, etc.

The fifth element is participation in major accidents. Now in the Dulles office we have no way of determining when we're going to have an accident or what type it will be. This order I've given you may not necessarily pertain because the first thing he might be faced with is a major accident and he'll go on it if it is. The ideal trainee understands quickly the reasons for all investigative procedures and keeps an open mind in the learning process. If he is other than ideal, he may possess a fixed attitude and it takes longer to teach him the fundamentals. After a year, he may know how to investigate accidents and he will support his probable causes, but you'll never know how accurate his probable causes are. Multiply a half dozen poorly investigated accidents each year by twenty such investigators and approximately one out of six of your fatal accidents will not have the correct probable cause for future preventive action.

Some of the minor problems we encounter are: One, whether the trainee should attend a safety school. Some say immediately and he hit with four weeks of concentrated material or whether he should attend the school six months or more after he's been working with us. So he may have sufficient exposure to accident investigation to be able to absorb the material at school. Again, it would depend on the intelligence, the ability and motivation of the trainee. Two, if the trainee attends the safety school immediately and then spends three or four months with us, is he ready to transfer to another office? Actually, his state of readiness is not necessarily a criterion as he can be supervised at his next duty station. In this case, however, if the trainee has a personal problem, to which so far there's been no satisfactory answer, his orders to the Washington field office will read "for one year duty." He moves his family to Washington, signs a one-year lease on a house or apartment and enters the children in school. Another move in a few months would raise considerable personal hardship. Three, the Washington field office has been designated as a training office in addition to its regular duties. The small turnover in all field offices of NTSB makes it obvious that there will be no need to train more than two or three investigators per year as an expansion occurs. This does not present the strong requirements for either a formal syllabus or a program of instructive development.

Perhaps consideration should be given to making a week or two available for the new FAA GADO/ACDO personnel, which will give them an opportunity to learn firsthand our requirements for reporting delegated accidents and give us an opportunity to expand our instructor training.

Our services could also be expanded to give the orientation training to foreign investigators. Somebody ought to consider this aspect.

In summary, the one basic problem that our office encounters in carrying out its training responsibilities is the trainee himself. It's not so much our problem as it is a problem or future problem for NTSB and the public. We could teach the fundamentals of investigation to any qualified applicant in a period of one year. This is where our job ends, but all we can guarantee is that he will know the fundamentals of investigation. An investigator's investigator is what we'd like to turn out. But this type must be discovered through the selection process - not produced by on-the-job training. Remember, he may be around for a long time.

Thank you.

SESSION 8

"Accident Investigator and His Problems"

MR. W. H. TENCH, UNITED KINGDOM

Qualifications. It is a fact that youth and experience do not go hand in hand and in the aircraft accident investigation context, an investigator, even if he is not an expert in the particular field of aviation concerned, must have sufficient experience of the subject to recognize the problem confronting him. This means that, in general, you need to recruit your investigator when he is in his middle thirties or early forties, however, inconvenient that might be to the administrators, if he is to have had the opportunity to witness the entire spectrum of aviation. Do not ignore the fact that our business is the rare event that comes about. So much for his age, what of the nature of his experience. We are a comparatively small organization which will not support many diverse specialties so we are divided into those concerned with operations and engineering. The most experienced pilots are usually airline or test pilots and this is our requirement. If such a pilot has engineering knowledge or qualifications, so much the better, but the vital attributes are flexibility of mind, and, that most elusive quality, the ability to write accurate and properly balanced reports. The qualifications of the engineer may be more difficult. There is a tendency to wish for the man with the best possible engineering degree but we are concerned with practical matters and the practical engineer with knowledge of the shortcuts, pressures to get an aircraft on the flight line, and at the same time knowledge in the airworthiness field, as well as a thorough theoretical ground, is, I believe, the best man to cover most occasions. In the U.K., a man who has served a true apprenticeship and subsequently obtained what we call a Higher National Certificate which might be equated possibly with a two year course in a Community College or Junior College, may, after considerable practical experience, qualify as a Chartered Engineer. Such is the type of engineering knowledge necessary on the wreckage site. This is not to say, of course, that there is no need for a man with an engineering degree, there is indeed, but purely academic qualifications without practical experience are not enough.

I will not comment on the qualifications of the pathologist, except possibly to say that he must have a substantial knowledge of aviation.

Training. We do not have a sufficiently large organization or regularity of intake to justify a definable training course, and, except for the obvious introductory instructions, we train on the job, by means of a tutor-pupil relationship. To the operational investigator, it may be necessary to extend his dual instruction for a substantial period before he had experienced sufficient exposure to the legal and even diplomatic realities of his future activity. With the engineers, a period of at least two years supervision is necessary before he goes off solo. There is no doubt that some engineers acquire an instinct for going about their job in the most effective manner whilst others experience considerable difficulty in assessing a piece of machinery other than in a complete state.

Equipment. There is a long list of equipment, including such things as cameras, compasses, note books, tool kits, etc., in the current (and shortly to be replaced) I.C.A.O. Manual of Aircraft Accident Investigation but it doesn't tell you what you need to move a 300 seat aircraft off a main road. In the U.K., a system has been developed and demonstrated whereby an aircraft can be moved over very soft ground by using hover-units which will in future be made air transportable. Experience in tropical forest or mountains and even normal countryside indicates that good communications with the man on the wreckage can save a great deal of time and add to effectiveness. A mobile headquarters with telephone link is considered essential and a radio link from the mobile headquarters to each man in the field completes the link-up with permanent headquarters. In order to permit the police to maintain the security of the accident site they must be able to recognize who is an authorized investigator and the provision of an easily recognizable arm band is a great help. They can be distributed to Accredited Representatives and other irregular investigators if need be. I mention only some of the less obvious equipment that may be useful on most investigations without going into the special equipment such as might be necessary when recovering wreckage from the sea or high mountainous terrain, not to mention the investigator's nightmare: the serious large accident on the polar ice cap. One thing I will say about specialist equipment and that is the investigator with a helicopter at his disposal is much more efficient and effective as a result. Finally, on this point, clothing. A properly designed suit giving full protection against wet and cold whilst still retaining the necessary freedom of movement is vital. Other people's equipment designed for other purposes does not necessarily fit the requirement. A good pair of walking boots that keep you dry well up the leg are of course fundamental.

Travel. The investigator must be ready to travel to the airport a few miles away, probably in his own car, or to the other side of the earth before he can start to be effective. He needs to be able to write out an authority with which he can get an airline ticket to wherever he needs to go and he needs to be mobile when he gets there. If he cannot obtain the use of a car he should hire one. Usually, the large operator (carrier) has a fixed procedure in the event of a bad accident which includes the dispatch of a relief aircraft. If you can arrange with the operator that in the event of an accident your team will be on the relief aircraft within a defined time of being notified then you are well placed.

Environment. The experienced investigator will always be ready for the unexpected because aircraft choose the most inconvenient places to crash. The high terrain accident can create problems of supply and organization. If you don't comply on site it may require too much of the working day climbing and descending and the investigator is too tired anyway when he gets to the wreckage to start thinking methodically. The helicopter may be the answer to this problem. On exposed sites, the investigator needs protection from the elements - or mobile or portable headquarters, whether it is to protect him from wet, cold and wind, or heat, sand and bugs. I know of one investigation in Australia where one or two people on the site suffered from heat stroke and it was necessary to require members of the team to keep in pairs when walking over the site about $\frac{1}{2}$ mile long. On another, in a tropical tidal creek soldiers stood by with rifles to shoot crocodiles if they appeared while the investigators waded waist high amongst the wreckage. But the average type of accident frequently

is on or near an airfield with all the necessary information and equipment at hand. It is in this circumstance that the investigator must resist the temptation to work for excessive periods. He, no less than the pilot he is investigating, may make the wrong decision when he is suffering from fatigue and in any case he will become more unbearable to his colleagues as he becomes more tired and as people become less tolerant of each other's little foibles so the efficiency of the investigation suffers.

Management. The good investigator must be a good manager, as well as a good technician and supervisor. Without proper management, the investigator could unnecessarily cause the expenditure of huge sums of money. Fortunately, we have an adequate budget for accident investigation in England. It is not, however, a bottomless pit, but it does enable funds to be provided for investigations like that of the Comet I, which cost over 1,000,000 pounds. You can be assured that our expenditure on accident investigations is very carefully supervised by the Treasury.

SESSION 8

"Accident Investigator and His Problems"

MR. C. GRIMES, NTSB

Thank you, Frank.

It's rather difficult to follow the two who came before me and definitely we in the team of investigating accidents have the same problem that Mr. Tench brought out. Of course, there are a few things we have that he doesn't and I will touch lightly on the qualifications, training, travel, real lightly on equipment. I think he's covered it real well, because we have exactly the same problems. And then research material. Of course, nobody has said yet what the ideal investigator is. The thing that we hear all the time or most of the time from the higher-than-we, shall we say, is that a real good investigator would be one that was twenty to thirty years old with his military commitment out of the way, twenty years as an airline pilot, 12,000 to 15,000 hours in a jet aircraft, a graduate engineer with a law degree, who also has his master's in management. Of course, on top of that, he needs to be in top physical condition and he should have a rather pleasing personality to go along with all of this. Well, when we get down to real life, as you all know, you've been seeing what we have in place of this twenty year old as we've been referred to in the past few days, lovingly I hope, as the old goats. That's not really what it is because we have some of the younger people in, but for the most part, what the NTSB has to draw from are ex-military personnel and ex-airline personnel who are from 40 to 60 years old, some are pilots, some do have engineering degrees, some are lawyers, some had military law, and some have had aircraft maintenance experience or those that are engineers. Very seldom do we have a combination of any or all of these. Many of them do have a combination of one or two of them, however. Some have law degrees and engineering degrees; some have maintenance experience, but this largely what the NTSB has to draw from.

We hope that the experience of these individuals has made up for the loss in some of the other areas and I feel, personally, that it definitely does. You can't expect, as Mr. Tench said, to have all of these qualities in an investigator. We are, we have expanded slightly in the last four or five years and we do hope to expand further to keep up with the additional aircraft that are coming into being, the different types of larger aircraft coming into being. As yet, Congress hasn't seen fit to allow this and part of this is our fault, of course, in the way we presented it, I imagine, to Congress. We're hoping in the next few years it may change.

Then Sam touched on the training for the individuals in the field office from our standpoint at the Washington office where, as most of you know, all of our team investigators are located. The problem is somewhat different. For formal training, we have NAAIS out at Oklahoma City and they're now coming around to the point where usually when a man comes on board or within a short time thereafter, he will be sent through this training. This has helped and I think will help in the future very much, because even though most of the investigators that have come to the Board are people with, well, all of them have had accident experience of some kind, accident investigation experience, however, regardless

of what new type organization you go into, there is a period of learning if for no other reason than finding out what their procedures are and how they go about it. Even though you know the procedures are the same as you have followed in the past, how you go about these procedures may be entirely different in this organization. And it usually is. Even though you move around within an organization. So that is one of the problems.

Formal training, we get into through specialized courses. These come on at standard times because it seems as though just about every time the training program becomes established, an accident will occur and people get set up to go at a certain time. At the time you get set up, you're in the middle of an accident investigation someplace or you get called off in the middle of it so your training is stopped. So, this becomes rather scattered.

We do have an opportunity at times though to get to go to some of the new schools or go for training when a new aircraft is coming out or things of this nature. We hope that this will be more applicable in the future as in the past, however.

Report writing. Most of us have been to report writing schools. We keep hearing that more of us ought to go again. Primarily me. But, regardless of this, we have had this facility available to us. It still does remain a problem.

On the equipment, at the present time, they have gone up from the Washington office to all the field offices and here we're behind you Mr. Tench quite a way. We probably should have been there some time ago. They've gone up to the field offices to have the field office check within their area, to see the types of equipment that are available, to handle these large pieces of equipment that are coming out like the 747, DC-10, 1011, and things of this nature. Because, as Mr. Tench pointed out, this moving of this equipment is going to be a very big problem if and when it occurs. Of course, we hope they don't occur for a long time, but we've been in this business, most of us, long enough that we know it's inevitable. So, as far as equipment is concerned, that is about the only thing that I think I'll bring up. Mr. Tench covered most of our problems in that area much better than I could and we do have the same problems.

When an accident occurs, we're expected to be on our way within two hours and to facilitate this, we usually use the FAA aircraft. We do not have any aircraft of our own, but the FAA, normally, if they have anything available, will make it available to us. Sometimes it's a DC-4; sometimes it's a jet, or a DC-3. Then on those occasions when the FAA doesn't have anything available for us, we catch the quickest airline out. Now that becomes a problem lots of times because for some reason, Washington seems to be one of the hardest places to get out of that there is, to get any distance. We can get to Chicago or we can get to St. Louis, or Atlanta, but then we have to change. So quite a few hours are taken up on this at times, but as I said, most of the time we go by FAA aircraft, particularly if it's beyond the Mississippi. If it's not beyond the Mississippi, then quite often we do go by commercial.

One other area that I would like to get into, there's been a lot said about it over the past few days, and that is a bank to store information. And I think

that this is something that is imperative we begin. It has started in many places. Moe's been talking about it this morning, but it's something that is an absolute must as far as I'm concerned. Several years ago, I became involved in it and in talking about aqua-planing and we did a little research project on it and found that there was a tremendous amount of material available or had been printed rather, not available, because you had to go find it, and I think that somehow we people that are in this business of accident investigation should try to push forward to get as much of this information as possible in a bank someplace in each individual country so that when somebody needs the information they can go to one place and be able to obtain it. This is impossible at this time, at least in the United States. Now it may be better than that someplace else, but here in the United States it is impossible. There is a tremendous amount of research that has been accomplished and yet it never gets out. Now, it's understandable because a lot of people, they're proud of what they've done. They don't like to have it being shortened in any way or in some cases maybe it's just jealousy. They don't want anybody to have it. They want to keep it entirely for themselves. Regardless of what the situation is, I believe that we should have a repository for all this information and the sooner we get one, the better off everybody will be.

We're getting along toward the end of our time, so I will leave the rest of mine for questions.

Thank you, gentlemen.

SESSION 8

"Accident Investigator and His Problems"

MR. FRANK YEEND, AUSTRALIA

Since I have been listed speaker for this session as well as being asked to moderate it, I want to take a little license with the topic, perhaps. And I'm not going to talk about equipment or travel or environment. But, because as Jerry Lederer has said, safety knows no national boundaries, and because we have a very large and growing body of international air traffic, one of the most important things which a forum like this might achieve is to better inform each of us of the methods adopted in other countries, of each other's attitudes, their successes and even of their failures.

Although Australia is a country of only 12 million people, we do have 4,000 aircraft on the Australian Register and 20 international carriers operate regular services in and out of our country. We are proud of our safety record. Perhaps you might be interested to know how accidents are investigated in our country.

As I said on an earlier occasion, we have about 300 of these accidents in a year, together with 7,000 incidents reported to us. These are all investigated by our staff of 40 investigative officers, who comprise the Air Safety Investigation Branch. Seventeen of these officers are located in the central office branch in Melbourne, and the remaining 23 officers are distributed between six regional offices. This staff, of course, is supported by the Ministry or clerical supporting staff.

The Air Safety Investigation Branch in Australia is a branch of the Department of Civil Aviation. So the distinction between the investigating body and regulatory body is not the same as pertains in the United States, and in some other countries, the United Kingdom, for instance. Nevertheless, there is a measure of independence, which is very necessary, you all know, for air safety investigation work given to this branch because its head is directly responsible to the Director General of Civil Aviation in Australia, Sir Donald Anderson. And the line of responsibility does not pass through any management hierarchy at all. We are the independent fact finders and advisers of the Director General with respect to safety matters in Australia.

The head office branch is divided into four sections. I'll talk about one or two of these sections. First of all, there is the Special Investigations Section, which is the section that I head up. This is a section whose activity is devoted to the investigation of accidents primarily, but sometimes incidents which are catastrophic in nature and, therefore, attract a lot of public attention. Or for some other reason, presents some particular difficulties, or engage press or parliamentary or public interest in a particular way.

I won't describe the detail of how we organize for these investigations, except that we are organized along the ICAO pattern, and you're all very familiar with that. I would say, that along with the United States, and some other countries, we were using the pattern of group investigation or

cooperative investigation, using manufacturers and operators, and pilots' federations. We have been using this system for the last 10 years; and in almost every respect, it conforms with the pattern now prescribed in the Appendix to the Annex 13.

On participation of parties, I heard George Wansbeek speak earlier in the week about the problems that he has as a teacher anticipated, perhaps, in accident investigation. I hope, George, that you never have to come to Australia on business as a participator, but I can assure you that if this is the case and this applies to many other operators, pilots' federations, or manufacturers that you will be welcome as participants in the investigation. You will bring advisors, I know, with you who will bring their expertise to the investigation, and we certainly will have you participating in Australia in much the same way this is done in the United States. I must say, though, that we expect, in participation, that the representative of the operator or the manufacturer will come and participate, not just because he is a member of that organization but because he can bring some particular expertise to the investigation of that particular accident. We say the role of the investigator has been a user, a coordinator, an extractor of the expertise which are brought from these various sources. It is my view that an Air Safety Investigator is a specialist in only one thing. That of being an Air Safety Investigator. He is no longer a specialist pilot, or engineer, or in any other relevant fields. He must use the expertise of other people, and his success or otherwise as an Air Safety Investigator is reflected in how well he extracts and coordinates the expert knowledge of other people.

One small point I would like to talk about is our methods. I listened with interest when Jim Childs talked the other day about our methods of wreckage reconstruction. We have found in Australia that we have distances which are comparable to those of the United States. We have found that it is our best proposition to remove and do wreckage reconstruction close to home base. We have moved wreckage without damage over 3,000 miles both by air and by rail in Australia and done a wreckage reconstruction 3,000 miles away from the scene of the accident. Certainly, before we attempted this, we spent two weeks in the field being perfectly certain that we had recorded photographically and by notes all of the evidence which we could possibly use in the lifting and transporting of wreckage. But having completed that, we then moved the whole lot 3,000 miles and reconstructed the complete aircraft close to the workshops, close to the scientific laboratories which could help us and for our own comfort, close to our hands as well. This, of course, was a project which took some two or three months.

We heard something earlier in the sessions about problems about press liaison. We have something of the same problem that you have in the United States, but not to the same degree. The problem of the uninformed journalist.

It is our policy in investigation work in Australia that the journalist comes along and he's told to get a story. If I don't give him a story or allow him to get a story, then he'll make one up himself. And so, bad publicity is my own fault, in my view. We always take a press relations officer along to a

major investigation, to a major catastrophe. We found it invaluable to have a person who is skilled in the field of journalism. They come from our public relations department and these people are people of considerable experience in journalism themselves, and it is they who look after the needs of the man who is there for a story or for photographs. They work very closely with the investigator in charge, and nevertheless, the journalist gets a great deal of satisfaction in respect to stories and photographs.

We produce factual reports which are circulated to participating parties in much the same way as you do in the United States. Finally, for these types of investigations, quite recently we've commenced to produce, special investigation reports, a sample of which is here. In fact, it's the first one we've produced which relates to the planning involved, etc., on how to stop accidents, in Sydney last year. This is just being produced and this is the forerunner of many further reports on investigations conducted by the Special Investigation Section. If any of you are interested in copies of the planning report, I still have two or three left and perhaps you could see me after if you're interested in having a look at those.

I'd like to say just one word about description of cause, at least so far as our attitude in Australia is concerned. I was very interested in listening the other day to Hal Fawcett of Canada describe his air lane method. Event-Link-Analysis Network, I think he called it. And I've asked to see it, because it sounds to me very similar to the methods of arriving at the cause of the accident which we've been using in Australia for quite some years.

But one principle we do follow, and that is that it is not necessary - in fact, it is most difficult in most cases - to try and write into the description of cause all of the lessons of an accident. We regard the description of cause as being a rather academic exercise. The public seems to expect the investigator to say in short, concise terms, what was the cause of the accident. But we all know that in many cases, this can't be done properly. Certainly we are trying to write all the lessons into the cause, but we can't ignore the lessons, because as most of us know, there are dozens and dozens of lessons that come up in an accident which might have nothing to do with the cause at all. But we would be failing in our duty, of course, if we ignore these lessons.

I'd also like to say a word about recommendations which arise from accident investigations. This is an attitude which we have in Australia, and I know it's not shared in other countries. In our view it's axiomatic, but the Air Safety Investigator must only point to the area requiring remedy or study. He must not pretend that after one accident study he is all seeing or wise enough to prescribe a new general rule which will affect all of our operations. This is the task of the regulatory body. Investigating an accident is like looking through a keyhole. One gets a good long view of what is inside, but let's not try to redecorate the room on this information. Let us just say that the man with the key should open the door and take a fresh look, because the wallpaper is certainly peeling off in one spot.

In addition to our Special Investigations Section, we also have an Engineering Section in the head office which, at this state, is comprised of only two professional graduate engineers. They provide for the consultation service on all air safety investigation engineering matters to our regional offices and of

course they head up the major engineering groups when we come to a major investigation. In this area we also have very good support from scientific advisors, such as the aeronautical research laboratories.

There are two other sections of the head office organization, but I have to save some time for Mr. Tibbs and although he said he didn't need much time, I think I should sit down at this stage and perhaps a little later in the afternoon, if the moderator will permit me, I'll say a little more about our organization attitudes in Australia.

SESSION 8

"Accident Investigator and His Problems"

MR. A. M. TIBBS, FAA

Thank you, Frank.

One thing that we've been listening to for the last few days, and often repeated, is the fact that communication is needed. It's necessary; and it's very important that it be on the spot when needed.

As a demonstration, we had out front earlier a van from the Eastern Region of the FAA which is one of two units that they have to serve as a command post for our communications from the accident scene. Each region really has similar types of accident flyaway kits, as the name was originally established in 1967 when the program was set up. The Southern Region, for example, has their two units; one located in Atlanta and one in Miami. Other regions have theirs located in several different areas, such as in the Eastern Region - it's composed of six parts - as their flyaway kit. In the Southwest Region it's the same. Alaska is a pack unit on a pack board weighing 75 pounds each and their units may be dropped by parachute or flown, packed in, or otherwise as necessary to serve a purpose. In the Alaska unit, two packs will set up a temporary communications site to reach the nearest FAA facility to then be patched in to headquarters.

In the demonstration during the lunch hour this afternoon, we will patch in directly to New York headquarters of the Eastern Region where the van is from or we will contact our Washington headquarters office direct by radio phone and then we will work through to Panama, Honolulu and Alaska. Naturally, since the NTSB is the responsible party in civil aviation, we will see if we can contact their lead man, John Haeffen, in Anchorage, to see if he's on duty for any accident that we might think of.

Communications provides us a way, not only to obtain the information, but to record the information, eliminate it, and pass it on to where action needs to be taken. When we think of an FAA inspector as being qualified as an accident investigator, you must consider he is really either an air carrier inspector, general aviation operations inspector, a maintenance inspector, engineer facility chief or otherwise that may be brought in.

The type of accident determines what type of individual may be assigned to this investigation. The type of accident dictates whether or not the FAA conducts the investigation, which they do about 85 percent of the time. There are 84 FAA general aviation district offices that cover the delegated area of accident investigation. We have 140 FAA offices around the world that would be available for investigation, assignment to that investigation or sent to that investigation if it was in another area and their expertise was needed.

Now these people, when they are assigned, may be assigned as coordinator, in which case, the NTSB would be conducting that investigation; or they would be the investigator, in which case the FAA would conduct the investigation and be authorized to call upon whatever expertise is needed from the FAA from wherever it might be.

Now the individuals, as they are set up, may further be assigned to a group within the organization of a field NTSB investigation or in the Washington team concept. When we move outside of the country, many times we are called on because of the limited number of people at NTSB, to act as the U.S. official representative. Which we do, as they so designate us to be. Otherwise, we are there as advisors to them when we're included.

Now in cases of many of the problems that come up, naturally, the individuals in the reporting of the occurrence, or the accident as the case may be, may need advice from headquarters or their field offices to determine what must now be done. We stand ready in the Accident Investigation Staff 24 hours a day, 365 days out of the year; eight of us standing this duty to assure that all notifications of occurrences as received would be passed to the proper people. Now, in this notification, if it's a minor fender-bender type accident, we would normally only receive a dispatch. By telephone call it's a more serious investigation, and the NTSB or the FAA would be conducting the investigation.

When we move to the various problems of these type people who are assigned to the investigation, in various areas such as we have discussed earlier this morning, training, familiarity of the people they're working with, makes a lot of difference in regard to how fast and how efficiently the investigation will be carried forth.

One of the areas that is becoming more and more in the eyes of the people one that must be solved is some of the areas of clothing in the environmental conditions that we are running into; water, undersea flotation gear, arctic and subtropic. Many of the other problems which are being faced now with the various investigations is carriage of hazardous materials, dangerous cargo. For example, it would be pretty serious if you arrived on the scene and moved in on the investigation of the wreckage and the occurrence and you find that three days after that you finally now get the paper work. The bit of information that tells you what was on that aircraft, that it was radioactive material, may not be available. You may obtain a geiger counter or scintillator. You move in, find out where it is, isolate it, and continue with the investigation. But in the meantime, all your personnel that have been working in this area have been exposed and could cause some serious outcome. So, these are the things that must be considered, now more so than ever, in our investigation.

Just the other day, an example of an occurrence came through where they took off the airplane a box of hot material. We asked what the hot material was. They said it was stollence. Well, we paused and waited, but they didn't tell us any more, except for us to ask, what are stollence? This material was taken off the airplane in such condition it was ready to ignite by spontaneous combustion and explode. Now, the stollence are no more than grass plugs for a golf green. But spontaneous combustion was setting up, because this box had been carried in the wrong place. But this wasn't a hazardous material as far as we were concerned. However, if it had set fire, ignited in flight, it could have caused a surprise.

Our investigation group here in Washington serves as a focal point to solve any of the problems that may come up in field investigation throughout the world. With us in on tap, with direct communications with the NTSB here at headquarters

many of the problems that do come up relative to international intrigue as far as who goes, you go, we go, when do we go, are your shots in order, are finally resolved. The same way with transportation of various people, and the need for certain expertise that may be on another pretty high priority assignment.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 9

November 4, 2:30 P.M.

"Unusual Investigations and Programs"

Moderator: Mr. Jerry Lederer, NASA

Washington, D. C.

SESSION 9

"Unusual Investigations and Programs"

MR. JERRY LEDERER, NASA, Moderator

I'll just mention briefly that Chuck McGuire is head of Apollo safety. Our organization is divided into various units. Under the Director of Safety, there is Apollo and Sky Lab and Space Stations and many other programs. Chuck is in charge of systems safety, which is a systematic approach to safety for all NASA and he is also coordinator with the Apollo program as Chief of Apollo Safety. He is a graduate of the University of California and he was with the Eighth Air Force during the war as a navigator. He's been with NASA in the days of Gemini. He's a graduate of advanced schools of management and technology. His talk will be about the Apollo 13 Mission failure. Apollo 13 was not regarded as an accident because everything came back that should have come back - the three astronauts and their capsules. But the Mission was not a success. It's not defined as an accident; it's defined as a Mission failure, and that is a different thing. He will tell you now what took place in the investigation and how the reasons for the Mission failure were determined.

By the way, there's one difference between the space investigation and your kind of investigation. In space, we never see the object that has failed. It is all done by telemetry. In this case by a photograph. But it's unusual that NASA does this type of work repeatedly without ever seeing the object they're investigating.

MR. CHUCK MCGUIRE, NASA

Thank you, Jerry.

Gentlemen and ladies.

At seven minutes and 53 seconds after ten on Monday, April 13, the Apollo 13 Lunar Landing Mission was aborted. Four days later an unbelievable combination of technical skill and inventiveness and a little bit of luck, the Command Module splashed down into the Pacific. That isn't what splashed down. This is the configuration area where the incident happened. That same day, it was the 17th, NASA Administrator Thomas Payne appointed Edgar M. Courtright the Director of NASA's Langley Research Center to head the investigation of the accident. With him on the Board were Mr. Ellinet, who is Assistant to the Administrator of NASA; Mr. Neil Armstrong, who is an astronaut; Dr. John Clark, the Director of the Goddard Space Flight Center; Brigadier General Walter R. Hedrick, Director of Space, DCSR&D, Headquarters, U.S. Air Force; Mr. Vincent L. Johnson, Deputy Associate Administrator in the Research House of NASA, the Office of Space Science and Applications; and Mr. Milton Klein, Manager of our AEC Space Nuclear Propulsion Office; and Dr. Hans Mark, who is the Director of Ames Research Center.

Two months later, the Investigation Board announced that they had the answer. What they had accomplished in that two month period with the help and talent of hundreds of engineers and scientists and government and industry

is, I believe, a classic investigation. The clues that they had to start with came from eyewitness reports of the crew, telemetry tapes. This represents the time line of the events. Detailed documentation of the systems that was available prior to launch, and a few fuzzy pictures from space like this next slide.

From the beginning the investigation led into one direction because of the data and the sequence of events. Just 16 seconds prior to the pressure rise in our oxygen tank cryogenic oxygen tank number two, the crew had turned the fans on in that tank. These fans are used to stir the oxygen and to prevent stratification of the fluid which was kept at about minus 297°F.

In addition, the pictures from space did show that some of it had blown off an entire panel and it appeared that oxygen tank number two was gone. The big question was what could have touched off an explosion in a tank. Examination of the tank's internals showed possibilities.

There was electrical wiring inside the tank which could short and cause an arc. There is material which could burn, but none of the materials were really known as combustibles. Inside the tank we had steel, aluminum, nickel, and teflon insulation. The most likely candidate of these four was teflon and tests were conducted at the Manned Spacecraft Center in Houston which showed the teflon insulated wire in 900 PSI supercritical oxygen burns rapidly. Supercritical is the temperature perhaps and also the pressure. It gives us some problems because when you get down to a low volume in the tank the liquid tends to stratify, you have liquid and gas, and in order to have a good feed to the fuel cells and to the environmental system, we have to have a homogeneous mixture and we also heat it to cause it to move around a little bit. Well, we discovered that in this oxygen that almost any material, including aluminum and steel, will burn readily, and we found that teflon would burn with a very nice flame and very rapidly. So, we felt that we had identified the flammable material. Now we had to find out where the ignition source came from.

Part of the investigation was to duplicate all of the out of the ordinary events that had happened during the preparation of the Apollo 13 vehicle for launch. One such event was the difficulty we experienced when trying to empty the oxygen tanks at the launch site during the countdown demonstration test prior to launch. The unorthodox detanking procedure that was finally used was duplicated in every way during the test. At the conclusion of the test, it was found that the thermostatic switches on the tank had overheated and were welded shut. Additional tests showed that the temperature of the thermocouples in the wire could rise up to 1,000°F. in spots. We then tested teflon-insulated subjects in similar temperatures and we found that the wire insulation cracked and fell off in flammable chunks. The wrap-up of all of this came in full-scale testing which duplicated the entire event.

The thermostats were up in this area. This is a capacity cage, a quantity cage, which uses the fluid as the capacitance. This is the heater with the two fans, top and bottom, to circulate the fluid.

This just shows where the thermostats were located and the heaters.

This is a photograph of the bay and this is actually the hydrogen tank which was in the lower part of that bay. The oxygen tank is up here. That's

number two.

The next slide we'll slide up a little bit. Here's oxygen tank number two. Number one is in behind it here.

This is the top part of the bay. These are the fuel cells up here that the cryogenic oxygen is fed to.

Now in the modification to the vehicle. Of course, a number of recommendations were made by the Apollo 13 Board and among the technical recommendations, two were to remove from contact with the oxygen all the wiring and the unsealed motors that would potentially short-circuit and ignite adjacent material or otherwise insure against a catastrophic, electrically-induced fire in the tank and to minimize the use of teflon, aluminum, and other relatively combustible materials in the presence of the oxygen and also potential ignition sources.

The modifications that were made, we went to three oxygen tanks because the stratification in these tanks only occurred when you get down below about 30 percent capacity and we added another tank so that hopefully we'd never have to run any of our tanks below 30 percent. We went to stainless steel in place of aluminum because we found that aluminum had a much higher heat output burning in pure oxygen than steel did. We put heaters in the tanks to remove the fans entirely. This was another modification that came out. We found that the valve we were using had some teflon wire in contact with oxygen and our indication system had to be changed somewhat, our caution and warning system, and, of course, no thermal switches.

This is the new interior. We have the same quantity-sensor about it, except it's stainless steel. The heating element has just the heaters and the heater sensors on it. This is the heating element itself that goes inside the tank and those wires are part of the heating element - three of them actually.

This is the capacitance probe, the quantity probe that is put down in the tank.

The reason I'm showing you these is because it shows the installation and this was really part of the problem. We felt that in the installation, which was almost a surgical process and done in the blind, there is a very good chance of crimping the wire. We have wires just running in the free there. Now all of the wires are sheathed in stainless steel. The temperature probe, the heater probe going down inside.

This is the capacitance probe that goes in after you have put the heater probe in and positioned it off to the side slightly.

The final thing we had to do in completing this job was to make sure that if this happened to us again we would have the capability within the service module, command service module itself, to get back. So we made some modifications and added some capability and now if we do have a failure in the worst condition, which would be after the men have gone to the surface, come back, and were coming around the back side of the moon and the lens supplies were considerably depleted, why we would have enough on board to get back with these modifications.

I think that Dr. Courtright's concluding statement in his report to the House Committee on Science and Astronautics really spells out our problem and I think it is a good place to finish with this discussion. He said the Apollo 13 accident which aborted man's third mission to explore the surface of the moon is a harsh reminder of the immense difficulty of this undertaking. The total Apollo system of ground complex, its launch vehicle and space craft constitutes the most ambitious and demanding engineering development ever undertaken by man. For these missions to succeed, both men and equipment must perform to near perfection. That this system has already resulted in two successful lunar explorations is a tribute to these people who conceived, designed, built and flew it. Perfection is not only difficult to achieve, but difficult to maintain. The imperfection of Apollo 13 constituted a near disaster, averted only by the performance of the crew and the ground control team that supported them. The Board feels that Apollo 13 holds an important lesson which, when applied to future missions, will contribute to safety and effectiveness of manned space flight.

SESSION 9

"Unusual Investigations and Programs"

MR. EDWIN V. NELMES, NTSB

The Investigation of Wide-Bodied Jet Aircraft Accidents

You might say my subject is a big one in more ways than one.

Last winter, an airline captain pulled back on a control column, rotated, and a Boeing 747 with more than 300 persons on board, lifted off and flew to Europe. Today, such flights are virtually world wide. Soon, the McDonnell-Douglas DC-10 and the Lockheed 1011 will join the 747 in transporting large numbers of passengers in aircraft of great size. We are in the age of the jumbo jet, and with it, we have all the attendant problems related to the investigation, in the event one of these giants crashes.

So far we have been very fortunate. The occurrences have been minor, when compared to what would happen if a jumbo jet is involved in a catastrophic crash. We hope that we never have to investigate such a disaster, because we hope such a crash never occurs. If we do, we are prepared, and continue to update our preparedness to cope with such a situation.

The Problems. We have problems and I know that you are well aware of them. Size alone will cause many of our problems. Considering that the 747 is approximately twice the size of a 707, has twice the area of wing and horizontal tail, and three times the area of the vertical tail, one can readily appreciate that when we get around to handling and moving wreckage, we are playing a different ball game from that played in the past. Actually, some of the components weigh as much as some of the fairly large aircraft we have and continue to examine in our investigations. For example, two engines from a 747 weigh nearly as much as a DC-3. So, not only must we have equipment sturdy enough and large enough to move the bulk of the wreckage, but we also need some pretty husky gear just to handle the components.

One of the most important problems is the handling of passengers. A catastrophic crash of an aircraft, with a passenger carrying capacity approaching 500, suggests an occurrence which approaches, in potential, a so-called natural disaster. The worst possible condition, in terms of required resources to cope with it, would be a jumbo jet accident in which half of the occupants survived with varying degrees of injury, and the other half perished because of impact forces and/or fire. Depending where such a crash occurred, the resources of a community, or even a large section of a state, could be overtaxed. The resources of a metropolis could be strained just to meet the sudden influx of so many dead and injured persons, not to mention the demand on its law enforcement and fire fighting personnel and equipment.

Another problem is the extent of the public interest and its effects. Such an accident occurring in a metropolitan area such as New York or Los Angeles would attract throngs of curious people. These must be controlled so that traffic lanes can be kept cleared for passage of rescue and fire fighting equipment, and other traffic necessary to the handling of the emergency situation. Such a crash would be extremely newsworthy and the news media would be there in force. Their activities need to be well coordinated so as to insure that their very necessary task is done with a minimum of interference with the duties of rescue workers and investigators.

Of course, a most important problem is the cost. The various facets of the handling of a jumbo jet crash of such a magnitude would obviously cost much more than one involving an aircraft of an earlier generation. One reason is that specialized equipment is needed to cope with the size. Also, as pointed out earlier, more personnel will be utilized, all of which escalates the cost.

The Task. Our task, then, is to handle these problems as efficiently as possible, and strive to keep the cost at a reasonable level.

In carrying out this task, manpower is of primary importance. Obviously, we will require more personnel in some areas than we have required in the past. Considering the size and complexity of the jumbo jets, and the numbers of souls which may be on board, at least two areas of our investigating team will be enlarged. These areas are airworthiness and human factors. One of our plans is to divide the structures group into three segments, each headed by a Bureau of Aviation Safety group chairman. These divisions will be airframe, flight controls and landing gear, and wreckage distribution and recovery. The powerplant group, under this plan, will split into a basic engine group, and an engine component group. The systems group will divide into a basic systems and an avionics group.

One plan for the human factors group is to establish four teams. These are medical, identification, crash survival, and human engineering. Augmenting these teams would be increased numbers of pathologists and physicians as well as skilled personnel necessary to perform the task of caring for the many injured and dead persons resulting from such a disaster.

Other groups such as operations, ATC, flight and voice recorders, etc., while requiring more personnel in some cases, will probably not change appreciably from their present functioning format.

Where do we obtain this manpower? The Bureau of Aviation Safety has not grown to the extent that staffing such a team can be accomplished without straining our manpower resources, particularly if, heaven forbid, another catastrophic accident occurs, or is under investigation at the same time. Lest we dismiss this thought as being improbable, just remember that two years ago, between the day before Christmas and the 18th of January, we were involved in the investigation of two accidents at Bradford, Pa., two more in the ocean off Los Angeles, and two in Alaska. Therefore, the Board may have to call on its field offices, for personnel, to a greater degree than in the past. We would hope that the parties to the investigation will provide their personnel as in the past, but in greater numbers than previously, if needed. In the human factors area, local and state organizations will, no doubt, play a larger role. It behooves us, then, to use manpower wisely and seek ways to reduce the numbers of personnel required, not only because of availability, but because of cost reduction.

Keeping the costs down may be difficult. Certainly, spreading the costs among all concerned will ease the burden on any single participant, as it has in the past. One tremendously important development in cost reduction is in the flight and voice recorder field. I doubt that anyone would question the value of the present equipment in our investigations. The causal area in many

cases may not have been determined but for these recorders. In the cost reduction sense alone, the rapid pinpointing of the causal area has saved untold hours of painstaking search for clues. We are now on the eve of being furnished information from even more sophisticated airborne data equipment. The information from such equipment could eliminate the need for, or at least minimize the time required for certain groups, particularly in the airworthiness areas. For example, such knowledge could determine that all engines were working prior to and at the instant of the crash. Thus, the need for a profound powerplant investigation would be eliminated. Similarly, the revelation from the data equipment could indicate that certain instruments, and therefore their related systems, were functioning properly at the time of the crash, thereby eliminating the need to go through teardown and inspection at the various factories and facilities used for such purposes. The savings in manhours, and thereby dollars, is obvious. The extent to which the coming generations of airborne data equipment will evolve may exceed our expectations. At the least, the parameters presently visualized will contribute most significantly to accident investigations in reducing time, manpower, and research; thereby reducing costs, and still result in a more comprehensible and incontestable end product, which is the probable cause and recommendations.

As we first pointed out, special equipment is needed to handle the wreckage and components of the jumbo jets. In the interests of cost savings, the placing of transportable kits at strategic places would obviate the need for having such equipment at every airport or community. These kits would include such items as inflatable bags, plastic portable runway strips, etc. This latter item was used successfully in getting a 747 back on recently at JFK. Since only a few such kits would be needed, the cost is again reduced.

Current and Future Activities of the Safety Board. During the past year, Bureau of Aviation Safety Personnel have attended 747 training at ground schools at factory and air carrier training centers. Additional training and the perusal of material received from the manufacturer and other sources tend to keep us abreast of recent developments. Last summer, Board personnel held discussions with the New York Port Authority, FAA, and air carriers in the New York area. At this meeting we learned of the plans to handle crashes on and near JFK and other airports in the New York area. This disaster plan included such items as the fire fighting equipment and personnel, their training, both on the airport and in the surrounding communities; provisions for security and control of vehicles, spectators, and passengers; medical facilities on JFK and coordination with nearby hospitals and military establishments; arrangements for helicopters and other means for handling of survivors; the availability of large equipment such as house moving vehicles, heavy duty cranes, etc.; and the availability of space to place components for examination, as well as shops for testing and teardown.

This discussion provided the groundwork for additional discussions presently being carried on with similar personnel in other locales in the United States. The value of these efforts will be in the increase of knowledge as to what immediate steps can be taken anywhere in the United States if a jumbo jet were to crash. In addition, an evaluation of the overall picture may be obtained, thereby determining where improvements may be suggested.

The traditional cooperation and assistance of the aircraft manufacturers, air carrier companies, FAA, many systems and components manufacturers, and others, has been outstanding through the years. Their contributions in manpower, equipment, expertise, and financial assistance, enables the investigations to reach a level of accomplishment not otherwise attainable. In coping with the investigations of accidents involving this new generation of jet aircraft, we look forward to a continuation of this same fine dedication to a common cause.

SESSION 9

"Unusual Investigations and Programs"

MR. FRANK TAYLOR, NTSB

Thank you, Mr. Chairman. Members, guests, ladies and gentlemen.

This subject, "Unusual Investigation Situations," is one which, I think, probably all of you have your own ideas on what they might be, so I'm going to talk on what I consider them to be. These are situations which affect your investigation plan and result in some alternative method and if not properly evaluated early in your program, you may compromise the quality of your investigation. You may compromise your accident prevention activities, such as recommendations and also may involve injuries to your people in the course of this investigation.

While I was coming over here, I happened to think of a case that was rather humorous. On an investigation we had up in New England about two years ago, we were advertising through the news media for witnesses to come forth who might have seen the airplane making a descent in certain areas of the terrain. One night I had a call from a young lady. The first thing that she told me was that she was a divorcee and she would be happy to have me come down to her house and she would take me in her bedroom and show me where the accident happened. This you may consider an unusual investigation situation. The witness group chairman, together with the whole group, interviewed this young lady and she had a very interesting story to tell.

Going back to our one accident that I would like to talk about, which I think covers all of the points that I previously mentioned, the compromise of your investigation, the safety, and maybe loss of time in your accident prevention activities, I'd like to use as an example an accident relatively old - it occurred in 1962 and involved a Boeing 377 operated by a large international air carrier. Operating non-stop between Rio de Janeiro and Port-au-Spain and then would continue to New York, this airplane disappeared after its last contact over the Amazon jungle. It was three days later that the airplane was spotted in the jungle by a large aerial search conducted by the United States Air Force and the Brazilian Government, as well as airplanes of the air carrier. And once it was determined that there were no survivors, a large plan was then put into effect to investigate this accident. The then Bureau of Safety, Civil Aeronautics Board, dispatched a number of investigators to Belem, Brazil, along with representatives of the air carrier, the CAA, Airline Pilot's Association, aircraft manufacturer and engine manufacturer, at which time a plan was organized for the best way to attack the investigation. Since the nearest town was approximately 35 miles away, it was a small Indian village on the bank of a river, one of the large rivers that flows north into the Amazon, it was decided that we would cut a 35 mile trail into the jungle to the accident site. At that time, the investigation people would then be flown into this village and with the aid of the Air Force, we would be transported deeper into the jungle by helicopter. The purpose of the 35 mile trail was to have a helicopter site cut into the jungle in an area approximately four miles from the wreckage. Also, in case of emergency, it was a method to walk out. Now, approximately two weeks later, we moved all of our people into the little

Indian village about 800 miles south of Belem. We were preparing the helicopter which was flown in from the United States by military aircraft and during this time we were advised during one of the aerial searches over the wreckage area that there were parachutes seen in the jungle. We later learned that a group of parachute clubs from Sao Paulo had parachuted a number of people into the wreckage area. There was great concern to all of us because the airplane (a 377), had had propeller problems. At that time it was using a hollow blade propeller and we had had some difficulty with the blade. It was then decided that we would get our people into the accident site as soon as we possibly could. As a result of this, we started to ferry people into the jungle without the enlargement of the helicopter landing area, although it was adequate for an S-51, and we reduced our technical investigation team, originally set up with about 15 people, to eight people. Of the eight people, four of them came from the Brazilian Government, because it was really an investigation under the ICAO rules. The accident site was at this time approximately five miles walking distance from the camp where we were dropped by helicopters. The weather condition at the time was just about at the mid-period of the dry season in Amazon country. Prior to going in there, one of our concerns was how to supply the people with adequate water and food. We knew that we had talked to the Indian Protective Agency, which is similar to our Bureau of Indian Affairs in this country, and we were advised that many of the waterholes in that area would be dried up, and we should be prepared to evacuate people someday due to the lack of food and the lack of water in the area. We were also advised that this area was in the Shavani Indian country. These were a fierce tribe of indians. We were advised not to try to make friends with them, to shoot them. There was a tribe of indians known which was relatively friendly, but not knowing the friendly ones from the fierce ones, we were advised to go heavily armed and if we came in contact with them, we were supposed to shoot these people. Now this created quite some problem with many of our people. It's the first I think where we've ever been on an accident where we were faced with this.

The investigation then proceeded. This team started to walk to the accident site, and it was over the jungle, extremely rocky and quite hilly; we lost three people the first day. One with a heart attack, which required the two Brazilians to carry him back. The other Brazilian was injured by falling over the vines on the sharp stakes that were in the jungle. We did have one Indian guide that led us to the accident scene. We were joined at this time by about 18 of the parachutists who had previously jumped into the jungle. They were out of water and without food. Each one of us carried two quart canteens. Our water supply was soon exhausted. We were able to spend approximately 18 hours at the accident site. We found that the aircraft had broken up in flight and we knew this occurred because the wreckage was in two distinct areas. The main wreckage area, which we reached this first time, contained the entire fuselage, the right wing, the number three and four engines, and the stub portion of number two and its engine mount. The outer portion of the left wing and the number one engine were not in this area, nor was the tail section. Half of the pressure bulkhead was missing. We had seen this from the air in another location. So knowing the previous experience of the airplane, particularly with the propeller problems we had had, we concentrated our efforts in the engine mount area of the number two. It was evident that the engine had come off in flight. Due to the lack of supplies and the

inability to be supplied by air, we were advised by radio that the helicopter that transported us in there was having mechanical problems and if we didn't get out, we'd probably have to walk out.

It was obvious that we couldn't get to the other wreckage area because no trails had been cut and our guide didn't know the exact location. So the decision was made at this point to return to our base camp and plan some other course of action. This we did and it took us some 18 hours to walk back. Many of the fellows that did make this trip over the rocky terrain of the jungle had their boots cut off their feet and things of this nature.

Now when we reached our base camp, we were soon advised that the leader of the parachute group had decided to hold the Brazilian Air Force Major and one of FAA's (CAA at that time) personnel as hostage until we could fly their people out in the helicopter. Well, the helicopter was in the process of failure of the tail rotor shaft and as a result, it made just eight trips before it broke down and there was not another helicopter in the area. On the last trip the helicopter made, they brought in a number of chain saws and sawed out a landing strip in the jungle for a light aircraft. This light aircraft was to be used for the purpose of releasing or rather carrying out the other parties. During the first landing of the light aircraft, they caught a propeller and nosed over. As a result, Mr. Magness of the CAA, and a Brazilian Air Force Major spent about 30 days in the jungle.

If I may digress here a minute, at this stage of our investigation, the only fact we really knew was that the airplane fell apart in the air for some reason. So, we reviewed our failure and experience with other like aircraft and other like components. We had been discussing the propeller with the CAA and had requested certain fleet campaigns be made to see what the experience of other operators had been as far as the model propeller. We also requested that some consideration be given to changing this model. At that time there were some very strict inspections the FAA had ordered by an airworthiness directive, but maybe these inspections should be increased.

While this was going on, this corrective action aspect, and most of our Americans returning to the States, we had discussed with the State Department the possibility of going back to the accident site under a different organized investigation. And some two months later, after negotiations with the Brazilian Government took place, we were again at the beginning of the dry season and we were able to fly in large aircraft and jeeps and we had the Brazilian Army using as an excuse an engineering maneuver to provide a jeep trail to the accident site. We also cut trails to the area which we had never been before, where we found the left wing and the tail section. I believe it was around the first part of August, we transported all of our people back and with jeeps we were able to get to the accident site. The trip took roughly about eight hours to travel 32 miles. So really, the road wasn't any four lane highway.

We were able to examine all of the wreckage, with the exception of the number two engine propeller, which we never recovered. By a process of failure analysis of the wreckage, we were able to eliminate all the possible causes of structural breakup. As I remember in the Board's report, we in our probable cause related this to the loss of the number two engine propeller which caused a structural upset of the aircraft.

This is an example of a case where we had a number of unusual situations which affected your best laid plans. It could have, it did, delay our corrective action activities or accident prevention activities, by some 30 days. Normally, on an accident after the first five or six days, we generally see areas where we start talking to the FAA about remedial action. On this one, due to the distances and the transportation, communication problems, we were delayed in this by some 30 days, but corrective action was taken.

In this accident, we also had some of our people injured and some of the parties to the investigation were injured. This, of course, affects the quality of your investigation because you lose expertise. You're a long way from the source of a replacement and things like this, so this is a typical example of what I would refer to as an unusual accident investigation.

Thank you.

THE SOCIETY OF AIR SAFETY INVESTIGATORS

THE FIRST INTERNATIONAL SEMINAR

November 2-4, 1970

S E S S I O N 10

November 4, 3:45 P. M.

**"Special Problems Associated with
International Accident Investigations"**

Moderator: Mr. Robert Froman, NTSB

Washington, D. C.

SESSION 10

"Special Problems Associated with International Accident Investigations"

MR. S. OHSAWA, JAPAN

Mr. Froman has advised a five minute limit, so I will keep my presentation as brief as possible.

Before going into the subject matter for this session, "Special Problems Associated with International Accident Investigations," to place these problems in their proper context, it might be advisable to give a brief outline of the regulatory structure for civil aviation in Japan.

Japanese civil aviation is administered by the Civil Aviation Bureau, one of several bureaus comprising the Ministry of Transport. Other bureaus within the Transport Ministry are charged with the administering of maritime shipping, ship building, merchant marine personnel licensing, railroads and highway transportation. The Civil Aviation Bureau in turn is made up of Engineering, Airports and Administrative Departments. In addition, the C.A.B. is charged with the administering of the Civil Aviation College, one of several sources of pilot material for civil aviation requirements.

There were four catastrophic air carrier accidents involving two foreign air carriers in 1966 and a select committee was formed on the request by the Minister of Transport. The select committee was composed of individuals chosen from the universities, industry and commerce and selected on the basis of their expertise in the field deemed essential to the accident investigation. Thus, the investigation was conducted under close cooperation with foreign authorities.

To review these accident investigations, an Aircraft Accident Investigation Division was formed. The A.A.I.D. is comprised of accident specialists. However, in a manner similar to the NTSB/FAA relationship, most minor, non-fatal accidents are delegated to the Regional Field Offices of the C.A.B. at Tokyo and Osaka International Airport. What then are the special problems associated with international accident investigations?

The general problems are no different from those outlined in yesterday's seminar, the necessary time lag in receiving required background information, types of the aircraft log, crew history, and so on.

The multi-nationality of the passengers involved will complicate the actual mechanics of pure accident investigation. Positive investigation of human remains, their disposal are compounded by the international nature of the parties involved. How can these problems be surmounted to get on with the job of finding probable cause? By maintaining close cooperation, not only between the special groups, but also among the various nationality groups involved in the accident.

The latter is extremely important in the case of a language difference. We have found that when this factor is not overlooked, misunderstandings as to the fact as well as opinion can be reduced to a negligible minimum. And gentlemen, if it can be done with us, the Japanese, it can be done with any nationality.

This is just a thumbnail sketch and if there are any further questions you may have, I will be only to glad to meet with any of you after the meeting.

Thank you.

SESSION 10

"Special Problems Associated with International Accident Investigations"

MR. W. H. TENCH, UNITED KINGDOM

The Accredited Representative must establish as soon as he arrives on site who is in charge of the investigation after which he should operate in association with the Investigator-in-Charge.

Establishing who is in charge may not be so simple with language problems, or certain aspects of the law may not permit the investigator from the Government Aviation Department full jurisdiction of his own wreckage. The police or examining magistrate or coroner may have greater rights than the investigator.

It is necessary at an early stage to find out the general legal authority and requirements in relation to aircraft accidents in the State you are concerned with and to establish the manner and extent to which it is intended to comply with Annex 13 of ICAO. Their interpretation of the Annex may surprise you. The Accredited Representative's advisers may come from a number of different organizations and some of them may not be acquainted with Annex 13 and it may be necessary for the Accredited Representative to remind the advisers that they are working for him and not for their employers. Furthermore, he must keep control of their activities and make sure that they are not merely collecting information for the use of their employer while the Accredited Representative can go hang. Their activities must be coordinated and controlled.

The Accredited Representative has certain rights as clearly stated in the Annex; generally they are rights of access to information and the State he is operating in may be very reluctant to grant the rights he has. In this case, it can be more conducive to the overall benefit to the investigation not to press the point too hard because the poor Investigator-in-Charge may be merely complying with his own law or doing what his boss tells him. The maintenance of a good relationship is more important. Then there is the other side of the coin. Not only has an Accredited Representative rights, he also has obligations and whilst his rights are written up in Annex 13, his obligations are not. If certain information from his own State, which is relevant to the investigation comes to his knowledge, the Accredited Representative has a moral obligation to pass it on to the Investigator-in-Charge. Indeed, even when he gets back home he is still the agent of the man conducting the investigation and should consider himself obliged to defend the requirements of the investigator.

The extent to which an Accredited Representative succeeds in becoming accepted by the Investigator-in-Charge as a working, contributing member of the investigating team is to a significant extent dependent on the personality and diplomacy of the individual concerned and a good, or indeed a bad working relationship can be the direct result of the manner in which he has tackled the job.

The Society of Air Safety Investigators
The First International Seminar

Closing Remarks

MR. C. O. MILLER, NTSB

Thank you, Jerry. I have just three quick points here. First of all, of the SASI members here, you recognize that you all have a number that was assigned to you when you became a member. I was fortunate to drag the guy who holds SASI Membership Card Number 1 out of his position as Chief of the Central Investigation Division of our bureau this afternoon; and I think for those of you who don't know the man who founded SASI - as I said, Number 1 SASI - he's back in the right - hand corner, Joe Fluet. And I think Joe ought to stand up and be recognized.

Secondly, since I've only been in government activity here for a little over two years, I want to convey to you, or prove to you that I know now how to be a bureaucrat. Because, you see, I've had many people come up to me throughout the last couple of days and say they thought the meeting was very successful. Well, since I'm seminar director, I'm going to take credit for it. Now, if it had been the other way around, if they had said it wasn't successful, then people like Jim Childs, Pete Goff, Bob Froman, Ken Scamahorn, Charles Connaway, Tom Collins, Jimmy Behram, and one other name at least that's not on the program, Frank Graves, those are the guys who would have had the credit for the thing not being successful.

In conclusion, I'd like to repeat something that Governor Reed said last night, that if you didn't hear it, I think you should. If you did hear it, I think it's worth hearing again. I for one am going to get this thing framed and put in my office. He said the following: "To look is one thing. To see or to look at is another. To understand what you see is a third. To learn from what you understand is something else. But to act on what you learn is really all that matters."

Thank you, gentlemen. Glad to have you with us.

