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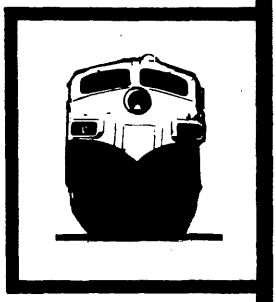

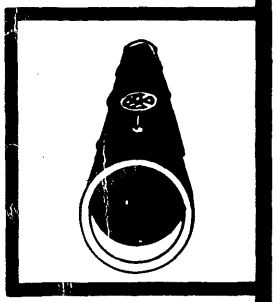

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

REPORT ON PROCEEDINGS

AVIATION ACCIDENT INVESTIGATION SYMPOSIUM, APRIL 26-28, 1983 SPRINGFIELD, VIRGINIA

NTSB/RP-84/01

UNITED STATES GOVERNMENT

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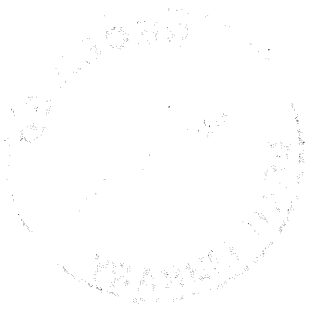

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In April, 1983, the National Transportation Safety Board held an accident investigation symposium to discuss Safety Board programs and to receive industry input on Safety Board accident investigation policies and procedures. Over 280 participants from industry, government and the military participated in the symposium on panels to discuss issues, and in working groups. At the conclusion of the symposium, the four industry-moderated working groups presented 57 recommendations to the Safety Board related to aviation accident investigation. Another 11 recommendations were submitted by participated after the close of the symposium. The report contains the recommendations and the Safety Board responses to the recommendations.

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FOREWORD

The National Transportation Safety Board was created by the Department of Transportation Act of 1966, which also created the U.S. Department of Transportation. The Independent Safety Board Act of 1974 established the Safety Board as an independent Federal agency, and broadened its responsibilities in the investigation and prevention of transportation accidents.

A primary mission of the Board is to investigate certain aviation, highway, railroad, pipeline, and marine accidents and to report publicly on the facts, conditions, and circumstances and the cause or probable causes of such accidents. The Safety Board has always recognized the important role of industry and government as parties and technical contributors to the Safety Board's accident investigations. Consequently, Board accident investigation teams, and especially aviation accident investigation teams, are composed of technical experts from the parties who support Board group chairmen and investigators in charge. The support of industry and government has provided immediate technical input to accident investigations which was otherwise not available because of the Board's limited resources. Working together, the Safety Board, other government agencies, and industry have operated the most comprehensive and successful aviation accident investigation program in the world.

The Safety Board maintains close working relationships with groups in the aviation community to insure that the support requirements of the accident investigation program are sustained. In addition to frequent contacts on an informal basis, the Safety Board has found formal meetings with the aviation industry beneficial to discuss aviation accident investigation matters in depth. The first such meeting was held in 1975 in Downingtown, Pennsylvania, where 170 industry and government participants discussed aviation accident investigation issues. At the conclusion of the meeting, industry working groups made recommendations to the Board to improve aviation accident investigation. The 1975 industry meeting was well received by industry and government and resulted in improved accident investigation programs. Consequently, in 1983, the Safety Board held another Aviation Accident Investigation Symposium including representatives of all major aviation groups who were also involved in planning the agenda for the meeting. Over 280 participants from industry, government, and the military attended the three day meeting, which was held in Springfield, Virginia, in April 1983.

The first day of the symposium was dedicated to a review of Safety Board accident investigation programs by Board staff members. Following the presentations, industry and government panelists, moderated by Board staff, addressed the major issues of aviation accident investigation. The major issues were: Washington "go-team" major aircraft accident investigations, general aviation accident investigations, the use of recorders and aircraft performance data in aviation accident investigation, and human behavioral factors in aircraft accidents. At the completion of the panel discussions, participants met in four working groups to formulate recommendations to the Safety Board to improve each aspect of its accident investigations. Fifty-seven recommendations were submitted by the four industry working groups. These recommendations are included in this report under the titles of the individual working groups which made the recommendations. Additionally, 11 other recommendations were submitted by participants after the close of the Symposium. These recommendations are under the heading of post-symposium recommendations.

The Safety Board has addressed each of the recommendations individually in this report. Most recommendations were constructive and provide suggestions which will enable the Safety Board to improve its aviation accident investigation programs. Some recommendations, however, stated essentially that the Board should take a course of action which already was policy in its investigations. These recommendations indicate that either the person who made the recommendation was unaware of Board policy, or that the practice of the Board investigators in the field was not in compliance with Board policy. In either case, it is Board responsibility to correct the issues raised. A few recommendations were not accepted because the Safety Board found that these proposed changes in procedure did not sufficiently improve existing practice.

The Safety Board is grateful for the many positive and constructive recommendations which have improved its aviation accident investigation programs. The Symposium has helped to establish better communications between the Board and industry. The Board also believes that industry and government gained a better understanding of the programs, policies, and problems of the Safety Board. This understanding will enable industry and government to better support the Safety Board in future aviation accident investigations to improve aviation safety.

Disc 249A

Thomas DeW. Styles
Director, Bureau of Accident Investigation
National Transportation Safety Board

Welcome to the National Transportation Safety Board's Aviation Accident Investigation Symposium. Personally and professionally I look forward to some very rewarding discussions in the next 3 days. I would like to talk a little bit about why you are here, since there are a number of reasons, but first I want to discuss the party system of accident investigation.

The party system of accident investigation is a combination of people with diverse interests and a combination of techniques and talents who work together under a Safety Board group chairman to investigate an accident. As far as I'm concerned it is the most efficient method for accident investigation. However, nothing is perfect, and, as a result, our primary reason for being at this symposium is to improve this system and make it work better for aviation safety.

Most of you have either worked as a representative for a party or will work as a representative if there ever is an accident that involves your product or your operations. As I say, we firmly believe in this system, and what we want to know is, how can we make it work better.

The other primary reason why this symposium was developed is that our present Board of Members, particularly the Chairman, indicate to us that they want to get the people who represent the parties, or who are potential parties, more involved in the everyday investigation of our accidents. We intend to do that, and we would like to ask you for your help to improve both our accident investigation procedures and the participation of industry in our accident investigations.

I would like to remind you, however, that the Safety Board is not just an accident investigation group. We were organized originally in two bureaus in 1966. There was a Bureau of Aviation Safety and there was a Bureau of Surface Transportation Safety. The Bureau of Aviation Safety was practically transplanted from the CAB. The Bureau of Aviation Safety had been performing the aviation accident investigation functions before 1966, and was transferred as a group to the National Transportation Safety Board.

From 1966 on, the Bureau of Aviation Safety became the leader in developing accident investigation techniques for the Safety Board. The Safety Board has built on this legacy from the CAB in the last 15 or 16 years, and these techniques are used to some extent in accident investigation in the other modes of transportation.

Like all good organizations, after awhile it becomes necessary to reorganize in order to meet new demands of the industry. As a result, in 1976 the Safety Board was reorganized. The current organization that we're operating under now is organized more on functional lines than on modal lines to facilitate accident investigation requirements.

We now have three bureaus in our organization — the Bureau of Accident Investigation, the Bureau of Technology, and the Bureau of Safety Programs. The Bureau of Accident Investigation and the Bureau of Technology provide the management of the accident investigations and the specialists in each technical specialty respectively. The

two bureaus work very closely to insure that there is a complete and free interchange of technology and expertise. The accident reports and safety recommendations are developed in these bureaus. The other bureau is the Bureau of Safety Programs. The Bureau of Safety Programs is a trend setter, while we in the Bureau of Accident Investigation like to think that we provide the foundation of data which is necessary for the Bureau of Safety Programs to survive. If you take to the Director of the Bureau of Safety programs, he will tell you that exactly the reverse is true. I think that the truth is somewhere in between.

To just investigate an accident and put the information into a computer or stick it in a public docket does not accomplish the purposes of the Safety Board. The people in the Bureau of Safety Programs are constantly looking at what is going on both technically, and I hesitate to say this, but they also examine safety issues from a political standpoint, and I do not mean that from the standpoint of party politics.

However, in order to be effective in this world, and particularly in the Washington community, you must be practical and appreciate the importance of "politics." We must look at what the climate is in all instances, and the Bureau of Safety Programs helps us do that. They point out some of the ways in which we can be most effective, and we use the information that we develop in the Bureau of Accident Investigation to be sure that we accomplish the goals and objectives of the Safety Board, so that the real purpose of the Bureau of Accident Investigation, which is the enhancement of safety, is finally accomplished.

One of the primary reasons for the Safety Board's current organization is that this organization helps us to interchange the technology and expertise that we have in all of the bureaus and divisions across modal lines. The other advantage to the present organization is that it allowed the Safety Board to place more emphasis on surface modes of transportation safety without degrading emphasis on aviation safety. I can state to you without fear of contradiction that we have and will continue to emphasize safety activities. This symposium is an indication of the priority the Safety Board places on aviation safety. However, when you stop and and think about the terrific safety programs, the terrific safety record of the aviation industry, and then look at the fact that 50,000 people a year are dying in highway accidents, you realize that the Board has to look very closely at the assets the Safety Board expends on aviation safety activities. I emphasize, however, that a very large percentage of our personnel and resources is still dedicated almost entirely to aviation accident investigation and the enhancement of aviation transportation safety, and that aviation safety will continue to be a high priority of the Safety Board. I want to add one last point with respect to the intermodal nature of the Safety Board.

If you look at the worst possible case in a transportation accident you will find that potential for a catastrophic accident is not in aviation. Even in a fully loaded widebody jet you cannot reach the worst potential that is found in railroad and marine accidents where large bulk quantities of hazardous materials involved. This fact does not minimize the importance of aviation safety, or the reasons for this symposium. The intermodal nature of the Safety Board in fact increases the total assets of the Board, which in turn allows us to devote resources to the mode most in need, while insuring adequate capability in all other modes. Finally, an intermodal structure provides a sharing and blending of talents.

You in aviation are leaders in safety, and are examples to other modes by the manner in which government and industry responds to accident investigation results and recommendations. The fact that you are doing this, and the fact that you constantly maintain the aviation safety record that you have helped the Safety Board and the other transportation modes establish safety goals which can be achieved by following your example.

Now just a few words about the next 3 days. You have probably noted from your program that today you're going to listen to some of the "experts" of the industry, and some of the experts are employees of the Safety Board. These investigators are not normal bureaucrats. They know what needs to be done, they know how to do it, probably better than anybody in the world, and they are constantly reminded by the Board and other people of the urgency of aviation safety and accident investigation. However, the real purpose of the symposium is to listen to you. As a result, this afternoon, tomorrow, and Thursday will be spent with industry telling the Safety Board how to do our jobs better. And we will listen, and take back what you say. I promise you that where warranted, we will change our procedures and the way we do business.

I am very, very serious. The meat of this symposium is in what you contribute the second and third days. We are not only interested in what you have to say, we need very badly need to know what it is that you are thinking, what your concerns are, and what we can do about them. We are not here to enhance any one organization, but rather, we are here to enhance aviation safety.

Be assured, however, that even though we do not put into practice all of the things that you may suggest to us, we certainly will seriously consider everything that is said, and I think that you will see the impact of it even though it may not be put in effect as a procedure or a technique.

In addition, the panel discussions and floor discussions will be informative and helpful, both for those who are taking part in the discussions as well as the audience in general. I do not believe it is possible to assemble a group of aviation experts that has the capability of contributing more to the discipline of aviation accident investigations than the one that we have here today.

I am biased in my attitude about accident investigation. Accident investigation has always been, and I hope it will continue, the basis and support for all of the other productive outputs of the National Transportation Safety Board. If we do not do a thorough accident investigation and develop all of the facts, conditions, and circumstances, the analyses, conclusions and recommendations of the investigation which follow will be flawed.

A word about the Board Members. Most of them are here, and will be here during the week, but they will not be acting in this forum as a legal body. I know of no other group other than our Safety Board, and when I say the Safety Board in this instance I am talking about the five Members, that has a format that results in a combination of technical, political and public review of accident reports, both in the production and in the publication of them. If you have ever been to one of our Board meetings you see the culmination of a very time-consuming and sometimes painful review and rewrite of accident reports. When the Safety Board adopts a report, whether or not you agree with the conclusions, we come out with one that has had a "murder board" look at it. I say "murder board" in the technical sense and not with any malice. The Board Members look at that report from every angle, and in most cases we are very pleased with the results of our reports in general.

Make yourself known to the Board Members. They, as well as the rest of us at the Safety Board, can profit by interchange with you. I encourage you to participate and share with us your concerns during the next 2 or 3 days. Thank you for coming, and for the combination of things that you're going to tell us that I hope will result in better accident investigation and in the end a much safer industry.

Thank you.

William R. Hendricks
Chief, Aviation Accident Division
Bureau of Accident Investigation
National Transportation Safety Board

The Aviation Accident Division has the responsibility for the investigation of major aircraft accidents. In addition to the major catastrophic accidents, this division also has the investigative/management responsibility for any other aviation accidents or incidents that are determined to have sufficient public or industry-wide impact and warrant a full or partial team investigation. These types of occurrences include air carrier incidents, and Part 135 commuter accidents. The Aviation Accident Division is also responsible for the preparation and coordination of the Board's formal accident report. In addition, the Aviation Accident Division has the responsibility for foreign investigations in which the Board designates a U.S. accredited representative in accordance with the guidelines of Annex 13 of the ICAO Convention. Our designated accredited representative heads the U.S. team of advisers who participate in the investigation of those overseas accidents which involve U.S. operators and/or U.S. manufactured aircraft.

To respond to a major aviation accident we compile on a weekly basis what is known as the NTSB "Go-Team," and there is a copy of a sample of this "Go-Team" also in your handout material. The Go-Team is headed up by an assigned investigator-in-charge, referred to as an IIC, who is also the designated duty officer and the principle contact point for off-duty hours requirements. The rest of the Go-Team is composed of technical specialists from the Bureau of Technology, who are in charge of the following investigative groups; the Operations Group, staffed by an operation-pilot specialist from the Operations Division, and are responsible for developing all operational areas and a history of flight.

The Weather Group is staffed by a Board meteorologist, and this group compiles and outlines all relevant weather data. Air Traffic Control Group, staffed by an ATC specialist from the Operations Division, are responsible for developing all air traffic services provided to the flight, and the ATC procedures and facilities that were utilized.

The Structures Group is staffed by a structures expert from the Engineering Division, and who is responsible for recovery, examination, documentation of the airframe and flight controls, wreckage distribution chart and when required, an aircraft mockup.

The Systems Group is staffed by a systems expert from the Engineering Division and are responsible for examination and documentation of all aircraft systems and systems components.

The Human Factors Group is staffed by human factors specialists from the Human Factors Division, and they are responsible for the crashworthiness, medical, survival, cabin safety, disaster planning and crash fire rescue aspects of the accident.

Power Plants Group is staffed by an engine specialist from the Engineering Division. They are responsible for the examination and documentation of engines, engine controls, propellors, fuel and fuel systems.

Now, Witnesses and Maintenance Records Groups, and although these two specialty areas are normally included on the team, they're usually filled by investigators from the field office that is nearest to the accident site or the company's maintenance base, as applicable.

We have also instituted a Human Performance Group activity which will be applicable to our major investigations.

All the investigators listed on the Go-Team are on 24-hour standby, 7 days a week. All are required to maintain a continuous telephone watch during off-duty hours, and we do have paging devices and an answering service to assist us in this responsibility.

The Cockpit Voice Recorder, Flight Data Recorder, and Performance Specialists are not listed on the Go-Team, and normally do not go to the accident scene with the team. These groups are convened in Washington, and their work is conducted in our laboratories after the recorders have been recovered.

Verification of an accident is usually provided by the FAA Communications Center which is located in the FAA Headquarters in Washington, D.C. They maintain an extensive worldwide communications network, which includes every FAA facility in this country and abroad.

Generally, the first indication of an aircraft accident would be known to the facility handling that aircraft, and their procedures call for immediate notification of the Communications Center through the FAA communications network in the event of a major accident.

When an accident of this type occurs, our duty officer is contacted by the FAA Communications Center and advised of the preliminary information concerning the occurrence. Usually the initial information is quite sketchy and may include only the name of the operator, the location, type of accident, type of aircraft, phase of operation, weather in very general terms, and injuries or fatalities if known.

The duty officer will then alert the Go-Team and, based on the preliminary data, a decision is made as to whether or not we will launch a full team or a partial team. In some cases it is readily apparent that a major catastrophic accident has occurred, and that a full Go-Team will be dispatched. In other types of notifications the decision is not clear cut. We may have an air carrier incident, a corporate jet accident, or a commuter accident that will only require a partial team.

In any event, when a decision has been made the IIC will coordinate with the appropriate Go-Team members and make arrangements to launch for the accident site, and we try to launch a team within 2 hours of notification. Prior to the team's departure to the scene a number of activities take place.

First, the NTSB field office nearest the location of the accident is contacted, and a field investigator is immediately dispatched to establish initial site security. Additionally, the State and local police authorities in the area of the occurrence are contacted and are requested to provide security at the crash scene, and also to coordinate any activities that they may have been involved with the first NTSB investigators to arrive at the site.

Transportation for the team to the accident site also must be arranged as quickly as possible. Normally we obtain or can obtain FAA aircraft from Hangar 6 at Washington National Airport. However, if one is not available or the accident location is a great distance away we will also use commercial transportation.

Another immediate consideration is the headquarters location in the field to accommodate the investigating team. For major accidents we will require a large meeting room, for the organizational meeting and for the daily team briefings, plus sleeping rooms or accommodations for between 50 to 80 people. We attempt to locate the motel headquarters as close to the accident site as possible.

When the team arrives at the scene one of the first items is to get an update of the details of the accident and determine the immediate action requirements. These requirements will depend on large part where that wreckage is located. For example, if the wreckage is located on the runway 4 right at Kennedy or in the middle of the city, such as at San Diego, an immediate decision will be made by the IIC as to the action to be taken. It may involve moving the wreckage or parts of the aircraft or staking it off to ensure that it is not disturbed. In all cases complete documentation and absolute security over the wreckage must be initiated and maintained. As a general rule, the IIC will inspect the crash site immediately after his arrival at the scene in order to get a mental picture of the wreckage location and site conditions, so as to have a good understanding of the logistics and equipment that will be needed to facilitate the investigation.

At the same time investigators are dispatched to the wreckage area to locate and return with the flight data recorder and the cockpit voice recorder. These recorders, when recovered, will be taken back to Washington immediately so that they can be worked on.

As soon as practical after the arrival of the NTSB and the personnel from the other organizations who are participating in the investigation the IIC will conduct an organizational meeting. This is the first meeting of the team. It is a work meeting that sets forth the operating rules for our investigation and also establishes the organizational structure.

At this point I would like to speak to one aspect of our methodology which we believe is the keystone to our major investigations—the parties to the investigation, or the persons officially designated by the Board to participate in the investigation. This aspect of our procedures has drawn considerable and varied comment through the years, and if I may, I would like to first discuss the Board's regulation pertaining to parties and then our policies concerning its application.

Board Regulation 49 CFR 831.9, Parties to the Investigation states in part that, (a) the IIC may on behalf of the Director, Bureau of Accident Investigation, designate parties to participate in field investigation. Parties to the field investigation shall be limited to those persons, government agencies, companies and associations whose employees, functions or activities were involved in the accident or incident and who can provide suitable qualified technical personnel to actively assist in the field investigation.

Provision (b) states that all participants shall be responsive to the direction of the appropriate Board representative, and that they may be removed from the investigation for cause.

Provision (c) states that no party to a field investigation designated under the regulation shall be represented by any person who also represents claimants or insurers. Failure to comply with this provision shall result in loss of status as a party.

Basically, this part of our regulation has evolved over the years as a means of injecting the most relevant and specific expertise available in the industry into our investigations. A simplistic but unrealistic alternative to this method require the Board to be fully staffed with all of the necessary specialists in every possible area with expertise in all types of aircrafts and components, and who would be immediately available for every accident or incident contingency. The Board would then have sufficient expertise available to conduct any investigation without the need for outside assistance. Although this would be desirable from our viewpoint it is obviously an impossibility from any rational or cost-effective standpoint.

Therefore, in order to get the best expertise available to assist us in fully developing all available evidence, we have developed our present system, which includes parties to the investigation, all operating under the rules that I have just mentioned. We fully recognize the limitations to this system, and the possible shortcomings attendant with it. However, we believe it is the most efficient and effective method available to obtaining the necessary expertise to complement the specialists on our staff. We also believe that this system has worked extremely well through the objective and efficient management by our staff and the personnel assigned to the investigation.

Some of the criticism that we have received on this procedure is that we have conferred special rights on particular groups and organizations which permit them immediate access to accident information, as well as privileges which may allow them to influence the investigation. On the other hand, the immediate access to information uncovered in the investigation which allows an involved organization to take immediate remedial action in my view is a desirable tenet. On the other hand, we fully recognize that all of the parties or organizations involved in the investigation, with the exception of the NTSB, may have a protective attitude toward their own products or personnel. We recognize that this attitude can exist, but we do everything we can to keep it from affecting accident investigations.

The only way that we can ensure a full and complete investigation is to maintain complete objectivity, and to keep the self-interest and litigation aspects separate from the investigation process. It may appear to be idealistic thinking, but it has been my experience that during the field phase of the investigation when the vividness of the tragedy is fresh in everyone's mind, and the broken wreckage is still smoldering in the ground, that people participating in the investigation, parties to the investigation and the NTSB alike, have only one pressing goal, and that is to determine precisely what happened and see that it does not happen again.

The litigation or product liability atmosphere or attitude is for the most part not apparent during the field phase of the investigation, and we are doing our best to keep it that way. Therefore, our regulation prohibits participation in the investigation of persons who interests lie beyond a legitimate scope of our accident investigation. The Board cannot permit its statutory objective to be compromised by allowing participation of persons whose interests are primarily determining the rights or liabilities of private persons and, accordingly, no party to the investigation will be permitted to be represented by a person who also represents claimants or insurers.

Getting back to the organizational meeting that is conducted at the outset of the investigation, it is at this point that the IIC will officially designate the parties to the investigation and, in his opening statement, set forth the basic procedures or ground rules that will be followed in the course of the investigation.

All participants will receive a handout that contains the basic guidelines for use in the investigation, as well as a copy of Part 831 of the Board's procedural regulations covering aircraft accident/incident procedures, and there are copies of this material also in your handouts.

One point that is stressed by the IIC at the opening meeting is that in accordance with our regulations, Part 831.12, any party to the investigation may submit to the Safety Board written recommendations as to the proper findings and conclusions to be drawn from the evidence produced during the course of the investigation. In this regard, we not only make provisions for you to submit your findings and recommendations, but we are earnestly soliciting you to do so. The Board believes that it is important to receive input from the parties prior to our determination of probable cause so that they can be considered during the formulation of our final report.

Each designated party to the investigation should appoint a coordinator who will act as the main spokesman for that party and provide necessary liaison between his organization and the IIC. The coordinator designates personnel from his organization to participate on the various groups. In this area we request that persons appointed to the various groups possess the applicable expertise for that particular area. For example, from the pilot union we would expect that the pilot designated to participate on the Systems Group would have an extensive background in that particular aircraft's systems, and the pilot appointed to the ATC Group would have an extensive background and knowledge of ATC procedures, etc. The same requirements apply to each party to the investigation. It is the responsibility of the party coordinator to ensure that the personnel that he assigns to the group possesses the applicable expertise appropriate to that group.

Once the investigation is underway we attempt to keep all participants fully informed as to the facts or information being developed. The IIC will usually attempt to conduct a daily progress meeting in which each of the group chairman reports on the full scope of his investigative activities for that day. A full discussion of all of the information being developed is encouraged, and any member of the team can speak up and be heard at this meeting.

The direction and scope of the investigation is framed by the IIC and the NTSB group chairmen. Comments and suggestions from the coordinators and group members is, of course, not only welcomed but requested. All relevant areas of investigation must be pursued in a methodical and objective manner, and it is incumbent on the IIC and the group chairmen to ensure thatt this is accomplished. A free flow and exchange of information within the team is a must. All persons designated to participate are expected to remain with their respective groups until the conclusion of that activity.

Prior to departing the scene all participants in the investigation are required to examine the draft of their group's report to verify for completeness and technical accuracy. This is a very important step. While you are out there make sure that you look over the group notes, be sure that they contain all of the information that you recovered during the investigation, that that phase of the investigation is complete and technically accurate in all respects prior to departing. This is the time to resolve any differences or to state any problems you may have with any of the group reports.

When all of the groups have completed their work at the scene the field phase of the investigation is concluded. In many cases followon activities are required after the field phase, such as engine teardown, examination, aircraft performance, simulator testing, flight tests, component examination at various facilities, additional witness examination, and so on.

All of these activities are still conducted using the team concept with all of the appropriate group members expected to participate in that phase of the followon investigation. Depositions or public hearing ordered in connection with the investigation require different procedures, but are still conducted using the team concept.

At some time after the investigative activities have been concluded, or a public hearing has been ordered and that proceeding has been completed, the Board will conduct a final meeting which we call a technical review. This meeting is conducted in Washington, D.C. by the IIC, and will include all appropriate NTSB group chairmen assigned to the investigation and the coordinators for all the designated parties to the investigation. The purpose of this meeting is to review all of the pertinent factual evidence for sufficiency and accuracy, and to determine whether the investigation is complete in all material respects. We will attempt to resolve any disputes or problems concerning the factual matters on record, or with any of the group chairmen reports.

This is also an opportunity for the parties to propose any additional areas of investigation which they may believe is necessary to properly complete the investigation. If it is decided that proposed additional investigation is both feasible and desirable this investigation will be carried on as expeditously as possible.

NTSB personnel in attendance at this meeting will not discuss analysis of the factual matters, or propose analysis or conclusions for the Board's final report. However, the parties are encouraged to express their views with respect to their analysis of factual evidence as well as any corrective action they may feel is necessary.

Following this meeting or upon conclusion of any additional areas of investigation the staff will formulate the Board's final report. Recommendations as to the conclusions to be drawn from the evidence submitted by the parties to the investigation under Part 831.12 will be considered by the Board during the report preparation and adoption process.

It is essential that these recommendations be forwarded in a timely manner following the completion of the investigation. It is also required that a copy of the recommendation submitted to the Board also be served on other designated parties to the investigation.

In concluding this part of my presentation I would say again that objectivity is the key to success in our accident investigation process, and this is the area that we at the Board cannot and will not compromise. I would also admit that the Board is not infallible, and that out of the thousands of investigations conducted over the years of approximately 900 general aviation accidents and 12 major investigations per year we can find some investigations that leave something to be desired.

To this end we must strive to improve. Nothing less than 100 percent factor of perfection is acceptable in aviation safety, and that should be our standard of quality for accident investigations. The aviation industry and the general public comprise our constituency and your needs must be fulfilled to the best of our ability within the scope of our statutory responsibilities.

A complete well documented investigation oriented towards accident prevention is not only your desire but it is our mandate.

Over the next couple of days I'm sure that we'll hear many comments wide and varied concerning our procedures and our investigations in general. This is the purpose of this meeting, to get your honest thoughts about our investigations both good and bad. I will, however, take this opportunity to point out this fact. The United States enjoys by far the safest air transportation system in the world. Our transport category hull loss rate for 1982 was one accident per 858,000 hours. Hull loss rate for the rest of the world was one accident per 338,000 hours, more than twice our rate.

I can point to a number of accidents, including the American Airlines DC-10 in Chicago, the PSA collision in San Diego, Air Florida 737 in Washington, D.C., most recently the Pan Am 727 accident in New Orleans, wherein those investigations produced timely, effective and far-reaching recommendations, as well as corrective actions by the industry.

I believe that these investigations, among many other of similar quality, including our general aviation investigations, reflect the expertise, dedication and effectiveness of our combined efforts in this work. The word dedication is often used lightly, but in this business it takes on a special significance. I think of our own investigators, many of whom over the years on the Go-Team have missed many holidays and birthdays, anniversaries, graduations and special family events while away from home on accident investigations. I also know that many of you have had the same experiences. But without this special dedication to the job of air safety we could not have accomplished the excellent record that we have.

In closing, I would like to borrow one of Captain Bud Leppard's favorite parables -- wherein he defines the difference between involvement in air safety and dedication to air safety. He sums up the difference this way. The chicken that gave you your egg for breakfast this morning was involved in your breakfast. The pig that gave you the bacon was dedicated.

Thank you.

James W. Danaher
Director, Bureau of Technology
National Transportation Safety Board

Good Morning. I also want to join my colleagues in extending a hearty welcome to all of you here today. I look forward to a very profitable and constructive 3 days together.

Earlier someone alluded to "straightening out" the Safety Board, and my topic this morning is a favorite one of mine, in part, because it is one which is sort of a paradox and which many would agree, needs straightening out. Probably no topic is talked about, maligned, lamented, criticized, or commented on more than the subject of human factors in accident investigation and aviation safety. As a result, I believe, judging from the volume of static and talk and papers and symposium, that it is a subject which certainly merits "straightening out."

I also believe Safety Board investigators have done a fine job in the past under difficult circumstances. I believe that this is one investigative area which in many ways is lagging other specialty areas. We have all kinds of sophisticated techniques for analyzing metal failure, or getting at reconstruction of wreckage sites. We have sophisticated at reconstruction of wreckage sites. We have sophisticated recorders, and so on. Yet the evidence can be quite elusive as a basis for getting at the underlying "whys" of human behavior; and also many times the underlying causes of injury and death occupy a great deal of our effort.

As I said at the outset, human factors is a kind of a paradox. On the one hand each of us is human; we can introspect; we have been there; we have made the mistakes. Many of us can say this. For that reason we have some basis for thinking and feeling and believing that we have a handle on the problem, and that with our many years of experience and long hours of observing the mistakes of others, we ought to be able to analyze and solve the human problems. But our progress is disappointing in some respects.

We still have a lot to fix. Therefore, I am particularly enthusiastic about this opportunity to talk to you today because at the Safety Board we have just recently been authorized to initiate a major program to enhance our human factors investigations of accidents.

Chairman Burnett has authorized the initiation of a program which would result in roughly doubling our staff size. We are working on improving the kinds of talent and skills we are going to bring onboard and the capability we hope to develop, so with this meeting as a listening session as well as lectures on our investigative methods, the timing is very good.

In my remarks this morning, I would like to review with you four basic aspects of human factors investigations. First, I would like to review the subject matter areas that we envision as being included under human factors. Next, I would like to touch briefly on what our present resources are, then discuss the Board's plans to enhance our investigative program, and finally discuss briefly with you some of the improved procedures for carrying out that program.

My remarks and this discussion will be directed toward the major investigations -- the ones that are directed from Headquarters. What I say applies in varying degrees and with minor adjustments to our investigations conducted by the various field offices. I will dwell on the major investigations because they are the most comprehensive,

and perhaps most familiar to many of you here. But our human factors people do indeed support selected general aviation accidents.

First, it is important to distinguish between the two major subdivisions of what people in aviation safety consider as making up human factors. One of these, the more extensive and traditional, is injury causation. This involves looking at what the injuries were, how they occurred, and what the sequence of events was that led up to them.

As part of this effort we get involved in reconstructing the crash sequence, analyzing from the evidence what the crash dynamics and the crash forces were, the adequacy of restraint, the leadership in the cabin, the adequacy of all the emergency procedures and equipment, the outbreak and propagation of fire and the consequences of reduced visibility, the toxic outgassing of burning interiors, and the direct effects of fire.

We are interested in the crash fire rescue response, the timeliness of arrival, the effectiveness of the firefighting, the rescue and the subsequent care of survivors. Through it all we attempt to correlate occupant injuries with the events, conditions and circumstances that might have produced or contributed to the injuries.

Because of the extent and variety of constituencies that the Board serves in this effort, particularly when a catastrophic accident is involved, considerable attention must be devoted to documenting all this, to interviewing the survivors, to documenting the injuries and reconstructing the sequence of events. Focusing on these survival aspects of accidents has made a major drain on our resources.

But perhaps the more obvious and important major division of human factors is human involvement in accident causation. Even more has been said about this, and it seems to be an ethereal unachievable goal. How do we get at the underlying whys to explain what happened? In many cases it is fairly easy with our present techniques to reconstruct the accident from a standpoint of what happened, but often the solid evidence just is not there to enable analysts to state conclusively just what the underlying reasons for the human behavior were.

So, to outline again for you a brief laundry list, and at the risk of belaboring the obvious for some of you: inquiry into the human involvement in accident causation requires that we determine what action or inaction the flightcrew, air traffic controllers, maintenance personnel or other ground personnel contributed to the accident. We determine what limitations or shortcomings in sensation, perception, cognition, judgment or reaction produced or led to faulty or inadequate human performance.

We are confronted with determining to what extent factors such as equipment design, work space layout, operating procedures, management practices and the physical environment may have affected human behavior which led to the catastrophe. And finally, we try to determine whether operator impairment or incapacitation was involved in the accident, as a result of preexisting disease, fatigue, exposure to toxic substances or ingestion of alcohol, medication or other drugs.

That's a tall order, and an extremely difficult one. But, if we are to make significant improvements we must make a concerted effort to reduce the extent to which the human element is involved in accident causation. So, our work is cut out for us.

The second topic related to human factors concerns the resources at the Safety Board to do this job, and then I will go into what kinds of expansion plans we have. Our present Human Factors Division is located within the Bureau of Technology. We have a staff of nine investigators, a secretary and a temporary clerk-typist.

The staff investigates not only accidents in the aviation mode, but in all other four modes; marine, highway, pipeline and railroad. Two of the nine investigators focus on the human performance aspects of investigation. Three of the investigators are dedicated almost exclusively to a general aviation crashworthiness project, and I will not dwell on that extensively, but it is recognized that survivability in general aviation aircraft accidents leaves a lot to be desired, thus we have an effort directed to that safety issue.

Frequently, comparisons are made between automotive safety and the associated restraints which are available in that mode, and the potential for survivability, and unfavorable comparisons are made between that the aviation mode. The Safety Board has a long history of recommending remedial action and improvements and frequently, almost incessantly, we have had only limited success.

Shoulder harnesses are now being installed in at least the front seats of general aviation aircraft, but our investigators are convinced that the design could be improved considerably. So, we have an arrangement with our field offices whereby they are selecting certain accidents, which are marginally survivable, to do intensive investigations and analyses. We hope to issue, within the next couple of months, a report which will outline a methodology for ultimately determining crash dynamics, crash profiles to describe what is survivable, what good features there are and what other features which need further improvement.

As I mentioned earlier, in describing our resources, three investigators are dedicated almost exclusively to this investigation and analysis program. The remaining five investigators look into the crashworthiness and survivability aspects, as well as the human performance aspects of accidents. In the past just one human factors investigator was dispatched with the Go-Team to cover both injury causation and accident causation in these major accidents. More recently, we have added these two human performance specialists to the staff, and we have begun to include such a specialist on our selected investigations as appropriate. This leads me to my next topic, our plans for the near future. Perhaps this is the central point of my remarks, and I would hope that it will spawn constructive comments from you and the working groups and the panels that follow.

We are currently developing plans for a much more detailed and systematic investigation of human performance in accidents, as well as more extensive coverage of the crash injury and the survivability factors. The Chairman and Managing Director recently approved staffing proposals which will enable us to bring on board a number of human performance specialists and survivability specialists. We plan to split the present Human Factors Division into two divisions. One will be concerned with crashworthiness and survivability, and the second division will be devoted to human performance matters. It is an indication of management's recognition of a long-standing need for increased emphasis on getting at the underlying whys for human behavior in accident causation.

To reflect this increased emphasis on the broad category of human factors we plan to have three Go-Team members available to launch, as appropriate, on major aviation accidents. They would obviously be, as I have said, crashworthiness, survivability and

human performance. We have position vacancy announcements on the street at this time to hire roughly 10 people in a variety of categories, and depending on our ability to attract talent and get it onboard, and get it up to speed, we hope to have this program in place within the next year.

I have already outlined the subject matter of human factors procedures somewhat for our proposed crashworthiness and survivability groups. They, in essence, are attempting to reconstruct the crash sequence in determining what happened and why people were injured, how to improve upon reliability in the function of equipment, and performance of cabin attendants.

With respect to our objectives, the technical approach, and the procedures for a human performance investigation, there are several things that it is, and several that it is not. First, it is not the Safety Board's intent to perform a "psychological autopsy" or to take a psychoanalytic approach in analyzing human performance in the accident situation, but rather to document operator behavior and the potential factors affecting that behavior as part of a systematic effort to explain the underlying reasons for it in a manner that is accident prevention oriented.

Now, that's a mouthful. It is very difficult to do. There are a lot of buzz words in that statement. What I am trying to convey is that we do not have an exotic new approach to solve the problems, but we hope to be more systematic and thorough in investigating and documenting human performance. Checklists are used widely in flight operations because of the fallibility of human memory and because of distractions in the flight environment. They are not a solution for flying; they are an aid to flying safely.

For these reasons, we have spent a considerable amount of time in helping in the development of a checklist to more systematically examine the human performance issues in an accident. This checklist covers six broad factors about which information is to be obtained. They include behavioral, medical, operational task, equipment design and environmental. Most of these areas are currently being looked into already, but not as thoroughly and systematically. For example, the behavioral profile would include such factual information as the individual's 24 and 72-hour activity, his eating and rest history, his life habit patterns, life events, future plans and similar factual information. That's behavioral profile.

The operational profile would include information such as operational training, experience, familiarity with the task, habit patterns, operating procedures as well as company policies.

The equipment design profile would be concerned with the interaction of the operator between himself and his equipment. Thus, that requires consideration of work space layout, display and instrument panel design and similar equipment configuration. That was equipment design.

The subject matter of the environmental profile is also fairly obvious. It includes the internal and external factors to the operating situation which could have affected operator performance. This includes external weather, lighting, visibility conditions, as well as internal illumination, ventilation, noise, vibration and related factors.

I have already said it, but it bears repeating: it should be emphasized that our approach to human performance investigations is not exotic and not totally

unprecedented. Many of these areas included in the checklist have been investigated routinely by the Board's staff for many years. We believe the improved results from this approach, however, will stem from a more systematic and comprehensive attack on the problem, as well as having the availability of people who are dedicated specifically to this human performance task, and who are well-qualified to do it.

We expect to launch a human performance investigator as a regular member of the Go-Team to gather information and report on that aspect of the accident. However, we also believe that a comprehensive investigation of this sort on every accident may be unnecessary, and in fact, impractical.

Therefore, early in the onscene phase of an investigation, as accident circumstances are unfolded, the decision will be made as to the level of effort to be undertaken. This investigation is not intended as a group effort in the same sense as the other traditional specialty investigations of the Go-Team. Instead, the human performance investigator will work in conjunction with the operations, other human factors groups, weather and traffic control, and other groups because of the extensive overlap of information being gathered by these other groups.

In a sense, the human performance investigator would function, in part, as an adviser to the investigator-in-charge and the group chairmen in determining the relevance of and the need for certain kinds of factual data, and then ensuring that such information is obtained.

You know, what is relevant, what is important in any given investigation, can change dramatically. Those of you who have been on the scene, one small fragment of information about the crew or about the crash circumstances, or about the function of an engine, the time required for takeoff or whatever, can quickly flip what is relevant and important. Sometimes the evidence is transient and if it is not gotten in a timely fashion, it is lost. So, that is one of the roles that we envision the human performance investigator to stay on top of, and to serve in an advisory capacity.

Now, I said that it is not traditionally a group effort the same way that the others are. But, at the same time, we do not rule out the formation of a human factors group. Instead, we believe that decision will be based on the nature and circumstances of the accident, and the facts and circumstances that unfold.

Our final item in our plans for the future also warrants brief mention. We hope to establish a computerized human performance data bank at Safety Board Headquarters. This system would involve the collection and coding of specific human performance information based on our investigative results. It would be structured around the previously mentioned six performance categories; behavioral, medical, operational, task, equipment and environmental. This system would supplement the Board's recently developed accident data system, and in some respects would provide an additional "handle" or means for accessing that larger body of information. Because it is just a preliminary notion on the part of some of our staff, we would solicit ideas and suggestions and comments from you.

It should be thoroughly understood that the investigative approach and proposed procedures for human factors investigations as I have tried to briefly outline for you are preliminary, in some respects they have been tried out only to a limited degree. We expect that with additional experience some of them may be changed. Again, we

welcome further discussion on the points I have raised later during the symposium, and further, we solicit your constructive comments at any time.

I thank you for your attention.

William G. Laynor
Deputy Director, Bureau of Technology
National Transportation Safety Board

Good morning, ladies and gentleman.

This morning I will speak to you about the Safety Board's technical support for accident investigations. Bill Hendricks earlier described the makeup of the Go-Team, and he stated that most of the group chairmen on that Go-Team come from the Bureau of Technology.

I would like to emphasize, however, that the Bureau of Technology and the Bureau of Accident Investigation work closely together. When the people from our bureau are assigned to an accident investigation they stay with that investigation, work very closely with the IIC and report writer, until their job on the investigation is completed.

The Bureau of Technology provides support for operations, engineering, and as already noted, human factors, as well as the laboratory functions. I am going to limit my discussion to the functions which seem to evoke the highest interest from the parties to the investigation, and also the media—the transcription of the cockpit voice recorder tapes and the readout of the flight data recorder, and the way in which the information from those pieces of equipment are used in aircraft performance analysis to reconstruct the accidents and the events leading up to the accidents.

Since the recorder installations are generally limited to the air carrier airplanes, my discussion applies primarily to our Washington Headquarters directed investigations rather the field investigations, because they are generally associated with the air carrier accidents. We do, however, assign field investigators from our field offices to investigate air carrier incidents and they will often involve recorder readouts just as well as the major accidents.

In either a major or a field investigation involving a flight recorder, these investigations are conducted as party investigations, and they almost always include the participation by the normal parties to the investigation. The conduct of the investigation is in accordance with the established Board procedures. The cockpit voice recorder transcription, the readout of the flight data recorders, and the aircraft performance analysis are all accomplished by our Laboratory Services Division. In addition to those responsibilities, the lab also has a metallurgical capability.

Many of you have visited or worked with the group activity in Safety Board's laboratory at one time or another, and are generally familiar with the facilities. For the benefit of those who have not visited the laboratory, I would like to bring you up to date on some of our recent acquisitions in terms of both personnel and equipment, our current projected capabilities, and our lab investigative procedures. Some of our procedures have been modified, and they will almost certainly be a major item of discussion later on in panel meetings during this symposium.

With regard first to personnel, the lab division has always been staffed with minimal numbers to do our job, but we think we have maximum quality. We are short on staffing depth, but we feel like we are high on expertise. The division was immune to the cutbacks suffered by the Board during the past few years. In fact, we have added personnel in some areas, and we currently have a couple of vacancies which we certainly hope will be filled shortly.

We have expanded the CVR specialist staff to two persons in the past years, so we now have the capability of having a little bit of redundancy in that area. As a result when one person is traveling, we can still conduct cockpit voice recorder readouts without holding up the schedule.

We have two flight recorder specialists and they are kept very busy. In 1980 we hired an engineering applications programmer when we acquired new computer equipment in the lab. His value will be apparent a little bit later when I talk about some of our new automation and graphics capabilities.

We have only one aircraft performance specialist. That is an area where we are short of personnel right now. We have a job announcement out, and we have several qualified specialists and we hope to fill that job very shortly. Our metallurgy lab is staffed with three metallurgists and I think some of them are here today, so if you have problems in that area you can probably talk to them sometime during this symposium.

I am not going to say much about the metallurgy, and there are no panels later on in the symposium to address specific problems in that area. However, if you do have any and you cannot find any of the laboratory staff, see me later.

As for the lab facilities, even with the budget squeeze we have managed to maintain a consistent program of modernization. We purchased nearly $350,000 of new equipment since fiscal year '80, and in the CVR lab we have enhanced our capability in modern filtering techniques and in performing spectroanalysis. We believe we have equipment around that is as good as any in the world to do the job of reading the CVR tape. We are still criticized sometimes, but we have to realize that as good as the equipment is if the tape doesn't have something on it you can't hear it.

The other area of the lab which has received considerable attention is our computer facility which is associated with the flight data recorder readout and the airplane performance analysis. More specifically, we have upgraded our plotting capability and we have added modern videographics. We are currently developing the needed software to do all sorts of wonderful things. For example, we already have the capability to reduce flight data recorder data or air traffic control radar data to ground tracks which can be overlaid on area charts and displayed as a function of time on a video screen. We can, with aerodynamic models, reduce flight recorder information to display aircraft attitude as it might have been viewed by a witness to the airplane performing a maneuver that is defined by the flight recorder. We can overlay binocular photographs, develop visibility envelopes, and depict the scene from inside a cockpit as it might have been viewed by a pilot. We do this in the investigation of midair collisions where we have radar track data, and we can project a target into the scene with reference to the pilot's eye.

We have also projected a runway into the visibility envelope from a cockpit, and using the flight data recorder we try to project the view that the pilot would have seen approaching a landing. We are quite excited about some of the accomplishments and we are really just getting started in that area.

Our metallurgical lab has also benefited from our modernization programs, and we believe that with our scanning electron microscope and new hardness testing equipment and some rather expensive photographic equipment that it, too, represents the state-of-the-art capability.

Now that I have described briefly what we can do, I will discuss the procedures which we have established for working with the accident investigation team. As in the past, a cockpit voice recorder and flight data recorder specialist, although not a part of the immediate Go-Team launch, are contacted immediately after we are notified of an accident and they are put on call. We will start immediately to reschedule activities in the lab and to prepare the facility as needed so that we are ready to go when the recorders arrive back in our lab.

After our investigation team arrives on the scene of the accident and assesses the situation, the IIC will normally advise headquarters personnel of any problems regarding recovery of the recorders and his estimate of when they will arrive in Washington. Meanwhile, the IIC is also responsible for establishing the flight data recorder and cockpit voice recorder groups. He does this in conjunction with the party coordinators and it is usually done at the organizational meeting.

As a rule, the selection or acceptance of the group participants is at the discretion of the IIC, and it is based on a party's interest and a potential for the group members contribution to the group activity. Also, our current procedure specifies that only one representative be nominated by each party, although we have some latitude for flexibility here. We can, in the case of differing expertise, have more than one representative on the group from a given party.

For the CVR group we have specified desired qualifications for party representatives. We want people to be qualified and current in the type aircraft involved in the accident, who are familiar with the flightcrew members' voices, and knowledgeable of the accident flight plan profile. Of lesser importance, we would like them to have some experience in CVR transcription. That is not a requirement, however.

Surviving flightcrew members will not be assigned as members of the CVR group. However, they will be given the opportunity in the course of the group activity to listen to the tape and comment upon the validity of the transcripts as they are developed.

In any event, the assigned flight data recorder and cockpit voice recorder group representatives will usually convene at our Washington Headquarters at a time to coincide with the arrival of the recorders. Usually the group members start convening before the recorders get there, because those people that work with us generally launch them directly to our lab when they are notified of an accident.

The recorders are recovered, generally by the structures group, and sent back to Washington by the most expedient but secure means; most often hand-carried aboard the FAA airplane or the commercial airplane. When the recorders and the group members arrive at our Headquarters, the CVR transcription and the FDR readout tasks begin. Any of you who have been involved with us will recognize the procedures that I have read so far. The procedures from this point on are those that I expect will evoke discussion, and although the Safety Board has, and will continue, to set the policy, we are looking for your cooperation and constructive suggestions.

The issue at hand is security, particularly of the cockpit voice recorder transcript. As you are certainly aware, this has been a growing problem to the Safety Board and also to the parties. It has received Congressional attention, in fact. It seems that in recent years the media, the general public, and litigant attorneys have become increasingly aware of the availability of voice recorder readouts. The media in particular views

the last conversation between the flightcrew in a catastrophic accident as juicy news material.

For the last year or so media requests for cockpit voice recorder and flight data recorder data have begun to come to our Public Affairs Office the day after the accident. Our General Counsel usually starts getting Freedom of Information requests. We are sure that the parties to the investigation are also deluged with media requests for information. Somehow the media seems to get piecemeal information. Often times in the past, before the CVR transcript was finalized, quotes started appearing in the newspaper and on TV. The quotes are generally inaccurate, and they are often taken out of context.

While this does not compromise our investigation, it has had the effect of providing harmful information to the public that has hurt some of the parties, and we recognize that it can influence their working relationships with us. As a result, the Safety Board has been sometimes the focus of criticism. Therefore, we believed that it was necessary to institute procedures for the recorder group activities in Washington and for the handling of cockpit voice recorder tapes and transcripts which would reduce the chances of such information reaching the media or the public prematurely.

Congress is also concerned about the media treatment of cockpit voice recorder tapes and, urged by ALPA, they passed a bill on October 14, 1982, which empowered --in fact, it required the Safety Board to withhold cockpit voice recorder tapes and transcriptions from public disclosure until the time of a public hearing, or 60 days from the date of the accident, whichever occurred first.

The Safety Board, while not instigating the bill, did support it. Its passage, however, reinforced our belief that stricter security measures were needed in our recorder investigation group procedures.

Currently, when the flight data recorder and cockpit voice recorders arrive at our Headquarters, the group members are given badges which admit them to our lab area. The lab area itself is kept locked and persons not having official authorization for entry are not admitted while group activity is in progress.

The flight data recorder group functions as they have in the past. The readout is performed, the listing of raw data in engineering terms is developed, depending on whether it is a full type or a digital type recorder.

Our computer facility is used to develop the plot of the data as a function of time, and as soon as the preliminary readout is obtained a copy is given to the Chief of the Aviation Accident Division. He in turn passes it to the IIC by the quickest method.

The flight recorder group chairman prepares his factual report, which is reviewed by the group given to the IIC, and then to the parties. It eventually will be entered into the public docket.

The cockpit voice recorder group, however, will function somewhat differently than they have in the past. I would add at this point that the procedures which I will outline have not yet been put to a real test in a catastrophic accident investigation. Furthermore, they are not cast in concrete.

When the cockpit voice recorder is available in the lab and ready to play back, the cockpit voice recorder group chairman and the Chief of the Aviation Accident Division or other NTSB staff management will listen to the tape. Significant information, a summary of conversation or events which would be of obvious interest to the onscene investigative group, that is, information which might guide one or more areas in the investigation, will be passed as soon as possible to the IIC by telephone. He, in turn, is responsible for briefing party coordinators and NTSB group chairmen regarding the significant tape content.

The tape itself, however, will not be played over the telephone, and the information given to the IIC will most often be a summary rather than a verbatim quote of conversation. There is no routine provision to copy the tape or carry it to the IIC in the field. However, depending on the importance and the quality of the tape, the Director of our Bureau of Accident Investigation can authorize the preparation and delivery of a copy to the IIC.

Our new procedures prohibit the IIC from playing the tape for persons other than the NTSB group chairmen who have a direct need to know. This will undoubtedly be a point of contention, but we thought it necessary in order to retain control. It is also a procedure that the Board might be willing to reconsider as a result of some of the recommendations which will undoubtedly come out of this meeting.

Meanwhile, the CVR group will assemble in the audio listening area, will listen to the tape, prepare a transcript, and determine even timing. Personal notes will not be taken. The group will work until a consensus agreement is reached on the contents of a handwritten unabridged transcript. Depending on the quality of the tape, the task could take from 3 to 5 days.

The CVR group will in preparation of a draft transcript suggest that portion to be transcribed and indicate their suggestions of deletions of nonpertinent and nonrelevant conversation. The final authority for the deletion of conversation resulting in an abridged version, an abridged handwritten version of the CVR transcript, will be the CVR group chairman and NTSB management decision. That is, what is to be deleted, and what is to be retained.

This copy of the transcript will be the preliminary transcript which is sent by the fastest means to the IIC when it is completed if he is still in the field. The IIC will permit NTSB group chairmen and the coordinators of the parties to the investigation to review the preliminary transcript. However, the IIC will retain custody and no copies will be made.

Normally, when the preliminary timed transcript is completed the cockpit voice recorder group will disband, at least temporarily. In the past each group member has retained a copy of the transcript for his or her respective party. According to our new procedures the cockpit voice recorder group members will not retain a copy of the handwritten transcript. The group members and party coordinators are, of course, welcome to come into our lab at any time after completion of the transcript to review its contents.

This procedure was intended to assure security of the cockpit voice recorder to prevent inaccurate and out of context information from reaching those not involved in the investigation. We realize that the procedures may be too strict, and we have already noted that some relief might be needed in order not to inhibit the followup investigation.

For example, we know that certain information on the cockpit voice recorder will have to be time-correlated with the flight data recorder trace in order to provide meaning to the events that led up to the accident. We have already decided that those cockpit callout which indicate airplane configuration changes, pertinent instrument readings, airspeed readings, for example, or altitude readings, onset of alarm, stickshaker activation, ground proximity warning system and so forth will be needed for further flight data recorder and performance studies. Further, we recognize that the original CVR tape may have to be used for sound spectrum study to determine engine noises and engine power. In this case, the original cockpit voice recorder group may reconvene, and the work will normally be accomplished in our own lab.

Our present procedures are not specific regarding the role of surviving crewmember in reviewing the cockpit voice recorder tape and transcript. If they are physically capable they will probably be invited to listen to the tape during the preparation of the preliminary transcript. The cockpit voice recorder group members themselves may be excluded from this audition if the crew desires. However, if the crewmembers find error with the transcript or the way it is developing these will be brought to the attention of the group.

In some cases surviving crewmembers might not be physically capable of coming to our lab before the completion of a preliminary transcript. In that case the flightcrew will be permitted to review the tape and transcript whenever they are able. The cockpit voice recorder will then be reconvened if necessary to resolve any problems or inaccuracies which were pointed out by the crew.

Some of these procedures will undoubtedly be worked out on an accident by accident basis. One almost certain compromise will be to release to the parties and to the working groups an abbreviated timed transcript containing only those callouts and events considered by the cockpit voice recorder group as necessary for further investigation in the field or further analysis or investigation of our flight data recorder information.

Currently our procedures would restrict the release of the cockpit voice recorder group chairman's factual report which would contain agreed upon transcribed portion of the tape in its entirety until our public hearing, probably the prehearing conference which just precedes the public hearing, or until 60 days from the time of the accident. That is in accordance with the public disclosure that is now law.

We recognize that this might not be tolerable to the parties who will participate in and need to prepare for the hearing, and in a case where crewmembers have survived the accident or even witnesses are to be interviewed or depositions taken as far as part of the investigation, it may not be tolerable to wait until just before that time to provide the parties with an opportunity to review the tape. These of course, will necessitate some considerations on our part, and we have to consider compromises to our procedures as needed to accommodate the requirements.

One other suggestion that has been made by ALPA is that a formal procedure be implemented to reconvene the cockpit voice recorder group at a time subsequent to completion of the other investigative activities. We agree that this could be useful, particularly if the cockpit voice recorder tape is of poor quality and the initial transcription contained a considerable amount of questionable conversation. We note that our present procedures do not require that the group reconvene, but they do not prohibit it either. Revisions to the cockpit voice recorder transcript that come about as a result of

reconvening the group will, of course, require group consensus, just as the original transcript did.

Another area which I wish to discuss very briefly is the aircraft performance group activity. Normally, the need to convene an aircraft performance group is apparent within a few days of the accident as the circumstances of the accident begin to fall in place. The scope of effort will vary from a simple plot of the ground track to a full blown aerodynamic modeling of the airplane and engineering simulator studies, and in fact, it has gone as far as flight tests.

The party coordinators will have an input through the IIC regarding the group activities, and they will be requested to provide the proper expertise in support of the group. The group may convene either at our Washington Headquarters, at the manufacturer's engineering facility or at one of the NASA facilities. NASA will very often be invited to become a part of that group to provide or lend their expertise to the Safety Board staff.

Our only problems with performance group activities have related to scheduling, particularly if we are highly dependent on the manufacturer's engineering or simulator availability. The second problem that we have been confronted with has been the release of engineering data, which has sometimes been constrained by a manufacturer's proprietary considerations. These issues will also be open to discussion in later panels during this symposium.

I did not really have time to do justice in describing our lab and its capabilities, and I extend to the people here the invitation to come in and visit our lab. We have also put together, our lab staff did, a video cassette which they're not movie producers, but I think they did a real fine job on this. It's about 15 minutes, and we're going to have it playing during the breaks from this point on. As you get your coffee you might wander in and take a look. It is a good video cassette of our lab facilities and shows the people at work.

There will be a panel on Wednesday afternoon which will address much of the subject matter that I discussed. This will be the time for your questions on wide range of issues dealing with the lab services.

Thank you.

David F. Thomas
Air Safety Investigator
Aviation Accident Division
National Transportation Safety Board

Good morning. During this portion of the program I will discuss the public hearing phase of the accident investigation and the accident report preparation. During the total accident investigation sequence, which extends from the moment that the accident occurs until a final report is published, it is not unusual that we see the least party participation involvement during the hearing in the accident preparation stage.

While I want to outline the Board's procedures for public hearings and accident report production, I also want to stress the importance of continued party input and participation throughout the investigation, even after the field phase is finished and even after everybody goes home.

The public hearing in an aviation accident investigation is an extension of the factfinding portion of the outside field phase of the investigation. The rules governing the public hearing are in Part 845, and these rules are included in the folder you have.

As you know, the hearing process is a public inquiry open to all. Its purpose is really two-fold. First, it is an extension of the field investigation wherein the sole purpose is to determine the facts, conditions and circumstances of the accident from which a determination of probable cause is made. The hearing is intended to be purely a factfinding proceeding, in which there are no legal issues and no intended adverse parties.

Secondly, it is intended to inform the public of the facts of significant aircraft accidents. Since most aircraft accidents receive extensive publicity in the media, they arouse public concern and tend to dispel confidence in the safety of air transportation. In a public hearing, through the expeditious disclosure of pertinent factual information, and a display of Federal Government interest in improving air safety, it can be an effective method for alleviating public concern and reinstating the confidence of the public in the transportation system. In addition, the public hearing serves as an effective forum for creating a permanent record of the facts, conditions and circumstances relating to the accident.

The determination to hold a public hearing for an accident is made by the Board in consideration of the recommendation by the Director of the Bureau of Accident Investigation. Of course, the onsite investigator-in-charge has a lot of input into the recommendation that goes to the Board.

Since a recommendation concerning the hearing will normally be sent to the Board within a few days after the accident occurs it is important that each of the onsite party coordinators start thinking about the specific issues that are involved in the accident, and about the need for a public hearing. In every case you should communicate to the investigator-in-charge your thoughts about whether to have a public hearing before you leave the accident site. You should give him your recommendations, the reasons why, and the important safety issues which you believe are factors in the investigation. In determining whether or not to have a public hearing held in connection with a particular accident investigation the Board considers a number of facts, and not necessarily in this order.

They consider the number of fatalities involved, the type of airplane involved, the type of accident. They also look at the repetitiveness of the accident type, the general public interest, and the accident prevention potential. One, or any combination of these factors may be involved in the decision to hold a public hearing. The same criteria would apply to a recurrence of accidents involving the same model of airplane, or perhaps a series of accidents involving the same or similar circumstances. Hearings are not held exclusively in connection with air carrier accidents, but also may be held in relation to general aviation, commuter or air taxi accidents.

The scope of the hearing, issues that will be examined, depends on the need to expand the facts and the data which were developed in the field phase, and the need of the Safety Board to look at other safety objectives or considerations.

Once again the parties have a responsibility to provide input to the Board about the scope of the hearing and the issues to be covered. As you know, you can have formal input into the hearing structure at the prehearing conference. At the prehearing conference the issues are discussed and the relevance of witnesses and supporting documents are examined. Many last minute problems can be eliminated if the party coordinators or spokespersons will provide concrete input to the investigator-in-charge and the hearing officer as early as possible in the hearing phase so that they can examine the full scope of it.

Once the scope of the hearing has been set, the assigned hearing officer, in connection with the investigator-in-charge and other bureau supervisory personnel, select those witnesses who can give the information which is most pertinent to the areas that are established at the hearing.

Parties to a public hearing are designated by the Chairman of the Board of Inquiry. This is one of the Board Members. Part 845.13, which you also have, states that the chairman of the board of inquiry shall designate as parties to the hearing those persons, agencies, companies, and associations whose participation in the hearing is deemed necessary in the public interest and whose special knowledge will contribute to the development of pertinent evidence.

The primary, and the only reason for having parties to the hearing as in the field investigation, is to assist the Board in developing all the relevant information pertinent to the accident. The designation of parties to the hearing is not meant to confer any special privileges or rights to an organization, but only to provide the Board with the specific expertise available from that organization. They are selected only to assist the Board in objectively developing the facts, conditions and circumstances pertinent to the accident.

We sometimes, and I would like to say more so in the past than in the present, have observations from the parties concerning the legal overtones of our public hearings. At some of the hearings the factfinding proceedings have more closely resembled a civil courtroom. In some cases there has been tedious, exhaustive and repetitious examination of witnesses by various parties, so that the real significance of the witness testimony is either lost entirely, or becomes so distorted that it does lose its meaning. As I said before, the public hearing is an extension of the investigation, and in some cases, the field phase of the investigation is still in progress. A courtroom atmosphere, rather than a factfinding proceeding, hinders the overall investigation and defeats the primary purpose of the public hearing, which is to develop the factual information of the case.

As a result, you should not be surprised if the Chairman of the Board of Inquiry gives directions to the parties which move the conduct of the public hearings away from

courtroom back to the factfinding proceedings. If you have an attorney who will serve as your party spokesman at a hearing, you should caution him about the nature of the Safety Board proceedings. Your should also stress that our hearing procedures do not allow for cross-examination in the courtroom sense, nor do they in any way allow or suggest an adversary proceeding as would result if these litigation-oriented tactics were permitted.

Further, I mentioned a prehearing conference, which is generally held about 1 week before the public hearing. Each party will have received all the available exhibits and a hearing outline. The parties are expected to be represented at the hearing by a hearing spokesman. The prehearing conference is informational. The issues of the hearing are stated and each witness and the areas to be developed with each witness are discussed. As representatives of the parties at the hearing, you have a very specific responsibility in the prehearing conference. You must be totally and completely familiar with all the facts and the issues in the investigation, and you must ensure that these issues are covered with the proposed witnesses, the areas of witness questioning, and the factual reports. Do not come to the prehearing conference just to collect exhibits, because the issues and the area of questioning which are finalized in the prehearing conference will be the agenda at the hearing. Procedures allow for the parties to present appropriate suggestions or comments pertaining to the areas to be developed, the witnesses selected and the scope of their testimony and the exhibits to be introduced into the docket.

Final acceptance of the comments or suggestions rests with the presiding officer and is based solely on the relevancy to the factfinding development. I stress again that at the prehearing conference you have a good opportunity to settle on the agenda and settle on the issues and settle on the witnesses and the scope of the testimony. Once you get to the hearing generally it will be too late to start changing the scope of the testimony or changing the witnesses.

At the conclusion of hearing, the presiding officer, in accordance with Part 845.27, describes the procedure under which any interested party, but particularly the designated parties, may submit recommendations to the Board as to the proper conclusions to be drawn from the testimony and the exhibits introduced at the hearing.

Any recommendations submitted under this procedure are evaluated by the Board and are made a part of the public docket. I should mention that this is an excellent vehicle for the parties to make known its views to the Board as to how the report should be structured, particularly as to causal areas. The Safety Board strongly recommends that each party send its proposed conclusions and recommendations to be drawn from the testimony and exhibits to the hearing — I cannot stress enough how important this is to the overall preparation of the final accident report and to getting the parties' views considered. The Safety Board wants your recommendations on the accident findings and conclusions.

The final phase of the total accident investigation is the preparation of the accident report and the safety recommendations. Of course, safety recommendations can come at anytime during the accident investigation or anytime after the report is adopted.

The accident report and the safety recommendations really are the most important aspects of the investigation from the perspective that the accident is described, analyzed, and a cause or causes are put down in a logical fashion. The accident report and the attendant safety recommendations are the Board's final products, and the vehicles by which we can influence safety deficiencies in the aviation transportation system.

The report-writing phase of the accident investigation proceeding commences after the hearing concludes, or if there is no hearing, after the onsite field phase is concluded and the followup investigation is finished. The investigator-in-charge, the report writer, the investigators assigned to the accident and the applicable management personnel meet at a work planning session to plan the report. The issues are further defined, the general direction of the report is developed to include the findings, conclusions and causal areas. Additionally, safety recommendation proposals are developed and support for the recommendations are planned in the report.

These posthearing and postinvestigation activities serve as an additional checkpoint to ensure that all safety areas have been developed and addressed in the accident report. The actual writing of the accident report requires from 2 to 4 months after the close of the onsite investigation or the public hearing. A production schedule is established for each accident report and it is approved by various levels of management in the Safety Board. For this reason it is important that your recommendations concerning the accident reach the IIC as soon as possible. The actual production schedule depends on the complexity of the accident, requirements for additional studies or investigative activities, and investigative work loads.

Although the schedule is established shortly after the field phase or hearing phase ends it is not an inflexible schedule which dictates the production of accident reports on a fixed basis. The so-called advancement through productivity program which stresses adherence to a specific accident report production schedule is not NTSB management policy. The Safety Board emphasizes the timeliness of accident investigations and the development of thorough timely accident reports. Although it is necessary to establish schedules for reports for work load and management purposes, the Safety Board will not sacrifice thoroughness or objectivity for a rigid production schedule.

The development of an accident report involves at least three different iterations of the report, each being reviewed by applicable specialists and supervisory levels for contents, technical accuracy and style requirements. The report is then forwarded to the Board through the Office of the General Counsel for review and approval.

After the report has been adopted by the Board Members it is released to the public. Advance copies of the report are sent to the designated parties before it is released to the public.

There have been suggestions in the past about a revised probable cause format. One suggestion is that the Safety Board should no longer determine the probable cause, but should list all contributing factors to the cause, the underlying cause of each contributing factor, and how each contributing factor could have been eliminated. The Board is aware that this format is used in some organizations. However, the present narrative format has been an appropriate vehicle for the determination of probable cause to date. The present format does list all probable cause elements to reflect a causal chain where they are apparent, and allows the listing of as many causes or contributing factors as appears to be justified by the facts.

This concludes my comments. I anticipate that there will be much discussion and many positive recommendations on this particular area as we progress through the seminar.

Thank you.

Rudolf Kapustin
Air Safety Investigator
Aviation Accident Division
National Transportation Safety Board

Good morning, ladies and gentlemen. It is a great honor and pleasure to be here this morning to address this distinguished audience of top aviation safety professionals from the United States, Canada and ICAO.

Based on 1982 statistics 85 percent of the 6,275 turbo-jet airplanes operating in the free world are manufactured and certificated in the United States. About 85 to 90 percent of the world's fleet of general aviation aircraft and about 77 percent of the free world's helicopter fleet is U.S. manufactured.

These statistics, combined with the fact that 149 countries are now signatories to the ICAO Annex 13, are the reasons the National Transportation Safety Board participates in many accident investigations conducted by foreign countries. I should say at the outset that anyone who is a position to be involved in accident investigations out of the country should be intimately familiar with all the provisions of Annex 13, and particularly Chapter 5, which deals with the functions and responsibilities of the participating states and their accredited representatives and advisers.

The Annex stipulates all of the different criteria for participation in international accident investigations and defines the functions of the accredited representative in great detail. The two basic, and also the most important functions of the United States accredited representative in foreign investigations are (1), to assure that the United States as the state of manufacture provides effective and coordinated participation in the investigations of accidents involving United States' manufactured airplanes and; (2) to assure that any matter pertaining to the airworthiness of the type and model airplane involved is quickly identified and that corrective action is started without delay.

There is a third one, of course, that we all recognize. We try not to harp on that, and that is assistance to the foreign country. Some of the countries do need assistance because they are not staffed or equipped, and in this day and age, large airplanes operate in practically every corner of the world into some small countries that neither have the financial or the technical resources to staff an accident investigation group.

The principal categories of accident investigations we normally become involved are, as I mentioned, the state of manufacture, the state of registry, and in cases in which fatalities to its citizens have occurred.

In the state of manufacture category ICAO, Annex 13, Paragraph 5.22 and .23 outline the details of that. We would participate upon invitation unless airworthiness issues or a wide bodied airplane was involved, in which case we would initiate participation without any invitation.

When an airplane with United States registry is involved, and this covered in Annex 13, Sections 5.19, .20 and .21, participation, then of course, is automatic. The last general category would involve accidents in which United States citizens were killed, regardless of the type of airplane or the location of the accident.

Participation in this latter category will probably be limited to one accredited representative and possibly one adviser once we had adequately justified the basis for requesting participation to the State conducting the investigation and permission to participate was granted.

The mechanism by which we become involved in these investigations varies from case to case. In most cases, particularly when there is a foreign air carrier involved, the initial notification may come to us, and that is, the NTSB duty officer, from the FAA communications center, or from the manufacturer's accident investigation person or safety officer who has received notification from his own company representative assigned to the air carrier involved. All manufacturers of course have service representatives assigned to all carriers who operate their equipment, so they are usually the first ones to find out about these things and they will call their own management, who in turn notifies us.

After we receive preliminary details of an accident, we will either send an immediate cable to the civil aviation or accident investigation authority of the country involved, or phone them directly to obtain additional information to offer our assistance, or simply to advise them that we will participate.

If the initial information received clearly indicates that airworthiness is involved, we do not have to wait for an invitation—we simply make arrangements to participate. Of course, we advise them of the fact that we are going to participate. From the moment that we make the decision to participate, all United States activities concerned with that particular accident should be channeled through the United States accredited representatives, who would have been designated immediately when the decision was made to participate.

The number and types of personnel from the FAA, air carrier, the manufacturer or professional organization to be functioning as advisers to the United States accredited representative should be very carefully coordinated with him before any quick decisions are made to dispatch indiscriminate numbers of people to a foreign accident site.

This is where some of our biggest problems have come in the past, and I would like to just cite probably one of the worst such cases in my experience. There was a Western Airlines accident which happened in Mexico City in October, 1979. Since the distance involved to Mexico City was relatively short, and Mexico City was quite readily accessible from the United States, and everybody at the time, unfortunately, was afflicted by DC-10 fever, most personnel representing U.S. parties of interest managed to arrive in Mexico City long before I did. When I arrived there and somehow gathered up and identified the persons who were intended to be my advisers I found I had 42 of them — that was about 32 more than were needed. This number included at least a dozen attorneys who were hiding someplace in the wings.

Some of these people included very high level government and industry officials, personnel who normally do not participate directly in accident investigations in foreign or domestic accidents. But they were there, and the initial result of their presence was an overwhelming effect on the Mexican civil aviation officials trying to conduct an investigation and of course upon myself, trying to coordinate some sort of organized United States participation.

Not only were they all there, but someone in that group managed to contact the Mexican investigator-in-charge and managed to instruct him that all meetings that he was going to hold were to be conducted in English.

Needless to say, things did hang on the back side of a power curve for a little while until to one of our Spanish speaking investigators convinced the investigator-in-charge that the United States accredited representative had arrived and would exercise necessary control over all U.S. personnel present, and that the person or persons who requested that the meetings be conducted in English spoke without authority, or without any direction.

It also became necessary for me to review with the investigator-in-charge the technical expertise of the United States personnel present. We made a joint determination as to who was needed and who could be used effectively as part of the investigative team. Persons that were not needed remained at their hotel and were briefed by myself at the end of each day. Since then we have had numerous informal communications with prospective participants to foreign investigations on the subject and, hopefully conveyed some of the lessons learned from the Mexico City experience.

There are cases when a manufacturer will receive direct requests for assistance from their customer which is the carrier involved in the accident. While we do not wish to become involved in, or impair the relationship between the manufacturers and their customers when these requests are made and the honored by the manufacturer, the United States personnel, i.e. all personnel employed by the U.S. manufacturer, are under the control of the United States accredited representative while involved in accident investigation activities.

This, of course, does not include personnel who are repairing an airplane which is damaged in the accident. If this activity is underway it is under the direction of their company. However, we believe that the term "customer request" may have been used at times to circumvent the involvement with the United States accredited representative. I should like to point out hastily, fortunately, that this has only happened on rare occasions. The important thing to remember is that foreign governments only recognizes the accredited representative as the spokesperson with official status in the investigation. The advisers are recognized as technical consultants to the accredited representative and are directly responsible to him for the direction of the United States participation in the investigation. For that reason it is essential and imperative that all requests for data, documents, technical assistance and other follow-on support activity from a foreign government are made through the accredited representative, and that likewise, all responses to such requests, whether they be from a United States air carrier, manufacturer or government agency, must be through the accredited representative.

Although Annex 13, International Standards and Recommended Practices in Aircraft Investigation, are the guiding documents for these activities, the precise application of the provisions of the Annex may vary from country to country, as some of you who participated with us well know, and they vary, of course, from case to case, depending on the country's internal laws, customs, religion, whatever, the structure of the investigative organizations and specific circumstances surrounding a particular accident.

We must always recognize this and remain flexible and be ready to adapt ourselves to the situation at hand without the risk of compromising accident investigation information, possibly delaying timely accident prevention action, or adversely affecting the future safety of the airplane.

I would also like to add at this point, the release of information is strictly forbidden in the foreign accident investigation. We, as United States representatives or participants, under no circumstances ever release any information. In cases where the flight data recorders or cockpit voice recorders are brought to the United States for readout, they remain in the physical custody of the foreign government investigating the accident. Although the work may be done in our laboratory, we have technically no access to the information, either transcripts or digital flight data recorder data.

It is also not necessarily true, that just because we participate in a foreign accident investigation and we send the accredited representative and it is a United States' manufactured airplane, that the flight data recorder and the cockpit voice recorder are going to be read out in our laboratory. This is strictly the choice and the decision of the foreign government investigator-in-charge.

In a recent accident, the flight data recorder and the cockpit voice recorder were taken to the recorder manufacturers Sundstrand on the west coast. In another case, a U.S. manufactured airplane was involved and the recorders were taken to the United Kingdom. There are excellent laboratories available other than ours. The United Kingdom, Canada, and of course, the manufacturer of the recorders.

So while we do not attempt to influence these decisions, we offer our facilities. If they want to use them, fine. If they do not it is their decision to take it elsewhere. Of course, we would like to be able to participate in every accident involving an airplane manufactured in the United States, whether it be a large turbo-jet transport or a small airplane or helicopter. However, this is not possible with the resources allocated to us. We must be selective, and of course, participate in all major accidents involving United States air carriers on foreign soil, and participants in the investigation of some accidents or serious incidents involving U.S. manufactured airplanes to be based on a potential safety payoff to be derived from such participation.

In some cases we have, and will continue to respond, to requests from foreign governments for the FAA or the manufacturer to dispatch persons in their capacities as advisers to the United States accredited representative. In many of these cases, while the representative is appointed, he actually remains in the United States, but still controls and coordinates the overseas activities of the advisers. Sometimes it is just not necessary to send an accredited representative. The function can still be served and fulfilled while the person remains in the U.S.

Whatever the situation may be, in order for United States participation in foreign accident investigations to be effective, we as individuals and representatives of the United States, no matter what our affiliation is here at home, must assure that everything we do addresses the objective of the investigation as stated in Chapter 3.1 of the Annex, which states, "The fundamental objective of the investigation of an accident or an incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability."

Rachel Halterman
Director, Office of Government and Public Affairs
National Transportation Safety Board

Good morning, your introduction was much nicer than the one I got earlier today when someone called me the new Ed Slattery.

I find myself in the unenviable position of trying to convince you of the advantages in providing press access to accident investigation information. That's almost as tough as trying to talk Jonah into joining the Save the Whales movement.

The fact of the matter is, media access is a necessity in a democratic society, so we might as well accept our blessings and cooperate with the process.

I may not need my allotted 15 minutes because the Safety Board's policy on release of information to the media and to the public is not at all complicated. In fact, it can be stated in one sentence.

As a public agency doing the public's business, the Safety Board disseminates public information to the greatest extent possible. Having said that I should just leave the podium and give us all a chance to have an early lunch. But stating the Board policy does not provide you with the vital ingredients of why we have such a policy and how we implement it. That's why I am here, and that's why lunch will have to wait.

Aside from its philosophy of openess, the Board's information policy can be viewed from a pragmatic standpoint. Keep in mind that the keystone of the Board's structure is its independence. We write no regulations so we cannot be accused of pulling punches when regulations are in question in an investigation. But we must depend on our public image—on our credibility—to give weight to our safety recommendations.

Nothing would destroy that credibility more effectively than a close-to-the-vest information policy that gave even an appearance of protecting someone in an investigation. For many of you the details of our work with the media will be familiar, whether at the accident scene, the public hearing or the Board's Sunshine meetings where reports are adopted. I ask your indulgence as I go into some detail so we can be sure that everyone understands our philosophy on media relations.

First, the Go-Team accident scene where the information pace can be pretty hectic. Almost every full Go-Team is accompanied by a Safety Board Member, and a Public Information officer. The Board Member, the Public Information officer and the investigator-in-charge--are the only spokespersons—for the investigation. They release factual information as it is gathered and confirmed by the entire team.

What is factual? It is information that does not require analysis. For instance, when our air traffic control chairman at New Orleans reported having heard five control references to windshear or to quadrant readings from the Wind Shear Alert System, we released that information. What we did not say, and would not speculate, is that the flightcrew heard them. That information had to await CVR readout and analysis.

We do confirm the obvious. When a tail section is half a mile from the main wreckage, we will state that there was an in-flight breakup. But we will not catalogue the various scenarios or possible causes of the in-flight breakup, much less speculate on them.

Flight or cabin crew statements to team investigators are summarized in accident team news briefings. Verbatim statements are not released until group chairmans' factuals are made public. But to refuse comment on crew statements to us would serve only to cast doubt on their credibility, and the credibility of the Safety Board's investigation.

Eyewitness statements may be roughly characterized but are not released verbatim until the group's factual report puts them into context. Information gathered from ATC tapes is factual and releasable. Tape copies and ATC transcripts are released by the FAA when the ATC group chairman tells us he or she is satisfied with the transcript. This usually takes a week to 10 days, depending on the FAA's resources and the ATC facility involved.

Information recorded in logs and maintenance records also is factual and releasable. Sometimes the bare bones of a maintenance entry appear to invite media misinterpretation or speculation. We cannot guarantee that will not happen, but we can and do place the material in context to the extent possible. And just to show you it goes both ways, there have been times when such a maintenance entry had gone unnoticed in the flood of detailed factual information we released along with it.

Flight data and cockpit voice recorder information initially are withheld but may be characterized very broadly. For example, to defuse an off-the-wall rumor we might say something like, "the tapes as well as accident information gathered so far offer no evidence of sabotage."

I could go on and on describing the Board's on-scene procedures, but I think you get the idea. We release factual information, we do not speculate, we try to place information in context, we do not wish to put anybody out of business.

Thus far I have discussed Board policy on release of information at major accident sites—those accidents which require a full Go-Team, which stimulate a lot of sophisticated national press; but the bulk of the Board's aviation accident investigation is done in the field by one investigator, covered by local media, unaware of what the Board is much less what it does. Usually these accidents involve general aviation aircraft. On occasion it will be an air carrier accident or incident.

Our policy with regard to release of information at these accident sites is the same. We respond—factually—to inquiries. Following the on-scene portion of the investigation, the next event usually is release of the working group factual reports, although sometimes there are early safety recommendations.

In public hearing cases, the IIC forwards to our public inquiries section all completed factual reports once he or she has received and approved a majority of them. When there is not hearing the majority of the factuals are due at public inquiries 60 working days from the date of the accident. The exception to the rule of releasing factuals is the cockpit voice recorder group report. Under a 1982 statute, CVR recordings and transcripts are exempt from Freedom of Information proceedings.

But that portion of the transcript deemed by the Board to be pertinent to the accident is made public at the opening of the public hearing, or the entire transcript is made available 60 days after the accident, whichever comes first.

At our public hearings, which generally are held only in the case of major accidents, duplicate hearing documents containing all the factuals and all their accompanying exhibits are at the press table. One is intended solely for reporters to use as they follow testimony. The other is for inspection by anyone who wants to see it, not just the litigants.

A Board public information officer is available at the press table to help the media in their hearing coverage in any way possible.

Finally, under the Sunshine Act the Board discusses in open session the draft accident report prepared by staff. The public is alerted of these meetings in advance, and despite our best efforts, the media, at times, describes these sessions as hearings. They are not hearings. All broadcast and print media may cover the meeting. In such overriding national interest cases as Air Florida or Pan Am, fact sheets are provided at the press table and camera platform, but the draft report is not made available before or during the meeting.

Probable cause language, report conclusions and safety recommendations are duplicated and provided to the media once the Board has voted to adopt them, often with changes the Board has made literally scribbled in. A public information officer is present at the meeting to assist the media. His or her draft report is available for media inspection on a first come, first deadline basis after the report has been adopted.

A news release is issued as soon as it is cleared by the Board. The full report as revised by the Board in the meeting does not exist for several days or a week or more. It depends on how much rewrite has to be done. Once a printer copy is ready, one-to-a customer xerox copies are available in our office to the media, government officials, interested parties and others who cannot wait for a full supply of the printed document.

So that's the why, and perhaps a bit too much of the how, of Board policy on release of information to the public. I am sure you can understand and appreciate the necessity for our open book policy. I just hope you remember what I say here today the next time it is your airline, your plane, your pilot. I will have to remind you when you call me. "As a public agency doing the public's business the Safety Board disseminates public information to the greatest extent possible." This is a recording.

Thank you.

Herbert Banks
Director, Bureau of Field Operations
National Transportation Safety Board

AFTERNOON SESSION

Ladies and gentlemen, first of all let me say that I consider this an honor, a pleasure, to be able to share with you some of my thoughts this afternoon concerning the Bureau of Field Operations.

My presentation has to do with field accident investigation, but I will vary that and broaden the scope of my presentation to include some of the topics that have arisen or been changed in the last 2 years.

Now, I have elected this 2-year time frame, or thereabouts, because of the fact that that is the time that I have been directly associated with the day-to-day operations of the Bureau of Field Operations.

Most of you know that the National Transportation Safety Board has the statutory responsibility of investigating all civil aircraft accidents. They also have the authority, which is also granted to each of the investigators in the 10 field offices, the responsibility to secure wreckage, mail, cargo, the aircraft and any property that is associated with an aircraft accident investigation.

This authority, together with the enthusiasm, with the responsibility of each of our field chiefs and the investigators assigned to each of the offices is certainly a powerful tool which must be used in a fair and impartial manner in any investigation. To do otherwise would compromise the reputation of the Safety Board in the eyes of the aviation community.

Over the past decade, fortunately, the number of general aviation operation accidents has continued on a downward trend. For example, in 1973 there were 4,090 general aviation accidents, of which 679 were fatal, accounting for 1,299 fatalities. In 1982 there were 3,276 general aviation accidents of which 574 were fatal accidents, resulting in 1,164 fatalities.

In the same timeframe, in 1973 there were 26.9 million aircraft hours flown compared to 36.2 million flown in 1982. And this is all in the general aviation field. When the load factors, and the increased aircraft speeds are taken into consideration, the above-cited figures presents a significant improvement in general aviation safety.

Certainly this record deserves the attention and acknowledgement of the entire aviation community, since the safety achievements include the input from each and every one of us here today, plus countless others, who have dedicated their life's work to aviation safety. No one organization, no one function can take total credit for the increased safety, but certainly, the results of our combined efforts reflect well on all of us here today.

The philosophy of the Board is simply and straight-forward with respect to the field investigation of general aviation accidents, and it can be clearly expressed in the following goals. Basically they are this:

One, to produce a high quality report in a timely manner. I think that each of us will recognize that the quality of the report and the timeliness of the submission of this report is indeed one of the goals that we must attain.

Next, assure that all personnel have the perserverance, the dedication, the training essential to successfully complete every investigation.

Three, assure that all available skills and facilities both of government and industry are used in each investigation to the extent necessary to fully develop the facts, conditions and circumstances to identify the underlying safety causes involved in each accident.

Next, maintain objectivity at all times to assure that each investigation is conducted in an orderly and thorough manner so that proper assessment can be made for the determination of probable cause.

Next, assure that every avenue of investigation is studied sufficiently to identify the hazards for which practical recommendations can be developed and, when effectively implemented, these recommendations certainly will promote safety in aviation transportation.

As you can see, the goals of the Board are to achieve the best possible investigation and produce the best possible report of each accident that is investigated. The latter is important because the report must be used for causal determination as well as development of recommendations for future safety enhancement.

These are idealistic goals, and needless to say, we do not always acheive these goals. However, we do strive for standardization, completeness, consistency and excellence in each field investigation report. The achievement of all of our goals remain one of our primary concerns.

The Board has placed great emphasis on computer technology. The Bureau of Field Operations has been in a position to coordinate and direct the efforts associated with this transition, to increase the use of the computer in accident investigation. The transition has not been easy, and the accomplishments have come at a painfully slow rate. Our first step in this transition was to develop a selectivity of accidents toward the investigation of those accidents that would produce the most safety rewards. We recognized that it was important to concentrate on selected areas or groups of accidents and have the ability in the future of varying degree over the entire spectrum of aviation.

Simply stated, we will spend more time investigating selected groups of accidents and less time on the remaining accidents. I want to caution you that this does not mean that we will compromise our standards regarding the overall accident investigation. We recognize that you would not allow the degradation of accident investigation without causing a strong vocal disapproval.

For that very reason we turn to the computer automation for the solution of some of our problems. I can state unquivocally that there will be no superficial investigations on the part of any Safety Board field investigator or his designated counterpart. To reflect a bit regarding the developments of the Safety Board's computer, many of you recall that previously the Board had developed a computer system and used the system for many

years. The Board's word in this field is recognized at the international level.

The Board also recognized that if we were going to improve the existing system into a larger more comprehensive data base of accident investigation information, the initial thrust had to be made at the field investigation level. To meet any of our future objectives for analysis of data that we may require, a method of collecting this data at the accident site in an organized and structured manner was necessary. Each accident required a prompt investigation followed by the availability of data related to the accident from the computer system in a timely, accurate and reliable format.

The most difficult task was the development of the new accident investigation form. The form had to be designed to provide the investigator with the capability of documenting and collecting the maximum amount of data in a minimum amount of time. Our intitial draft of the accident form, which encompassed the 1982 calendar year accidents, proved to be very successful from a data collection standpoint, but extremely difficult for use by investigators in the field.

Therefore, a streamlining or modification of the accident investigation form was necessary to accommodate the NTSB investigators as well as the FAA investigators who work with us on accident investigations. In September, 1982 a task force comprised of representatives from the FAA and from the NTSB was convened for purposes of redesigning our initial efforts, hopefully to make it a more useful product as a form of investigative tool.

Although we are still in the process of fine tuning the form created by the joint task force most of the work has been accomplished. I can say at this present time that the efforts put forth by both the FAA and NTSB and the aviation community at large certainly paid off. It paid off because we all recognized that there was a common goal that we must reach, and we left no stones unturned to make sure that we reached our intended goal.

We are pleased to announce that both the FAA and the NTSB investigators in the field are now using this form with a great amount of success.

I will mention very briefly two ongoing programs that demonstrate our efforts in the investigation of accidents in utilizing this selectivity criteria. Both these programs have or will be most likely covered in much greater detail by other speakers today.

However, the crashworthiness program in the field investigation and the human factors performance projects do require discussion, since they could not be accomplished without the cooperation of the field investigators, both from the FAA and from the NTSB. Basically the crashworthiness program includes investigation of aircraft accidents to determine the adequacy of aircraft design, current practices in use which in turn have a direct effect on occupant survivability. In this type of investigation our field investigator is interested in ascertaining the impact conditions of the aircraft, the amount of structural deformation, the approximate forces imposed on the structure and the occupants, the occupant injuries and injury-producing mechanisms.

The field investigator works very closely with the Headquarters crashworthiness specialist, which has been mentioned briefly here this morning. The crashworthiness specialist's documentation of this information is vital, and it must be a two-way street, because the investigator in the field does not have at his disposal all of the background

information, all of the data that is necessary on the side of the mountain when he is doing his investigation that would be available to the crashworthiness specialist back here in Washington.

Our initial efforts had concentrated on a single-engine fixed wing aircraft. It is our intention to promote technological advances in this area with the hope of not only would we save human lives, but also prevent disfigurement and serious injuries to pilots and passengers alike.

A short comment on the human factors portion of the program in the field; it is based on finding out the why. I would like to pause for a moment and say that the "why" is so important in accident investigation. It is very easy in a lot of cases to determine the cause, but why did it happen? With an accident involving an operator's behavior, it is not the intent of the Board to perform a psychological autopsy, but rather to document the operator's behavior and any potential factors affecting that behavior. The list could go on, and on, and on.

Once again, the field investigator is instrumental in identifying accidents for the use of this program and works closely with the Safety Board Headquarters specialist. I cannot emphasize too much that the field investigator depends largely on the expertise, in many cases, of our Headquarters' specialist back here in Washington.

It is our belief that emphasis in this area is and should be increased to the fullest capability, especially in the general aviation field, where there is so much more individual freedom in the conduct of a given flight. It is a well known fact, and I regret to say this, that approximately 85 percent of our general aviation accidents in some way involve personnel error. I would hope you would take very close cognizance of the words that I used. I did not say pilot error, I said human error, in some way or other.

I can say now that in the year of 1983 there will be upwards of 4,500 general aviation accidents. If the records hold true about 3,000 of these accidents will be determined to have human error involved, either as a factor or as a cause. This is unacceptable to the Safety Board, and it surely is unacceptable to the aviation community.

In addition to these two major accident selectivity programs the field is involved in many other areas of selectivity, and I will give you a few of those for now. In our selectivity program as it stands right now, working with the FAA, we are concerned with all newly certificated airplanes. We are also vitally concerned with those accidents involving weather, where the pilot has continued from VFR into IFR conditions after having received a weather briefing. In-flight breakups is another one on our list. In-flight fires is certainly on the selectivity program. This is just to give you a few of the areas where the Bureau of Field Operations is concentrating its efforts in an effort to help the entire overall program.

We believe that in the future our new expanded accident investigation data base will provide the aviation industry the knowledge in many areas of investigation which we could not obtain a few years ago. I may add this point that, starting with 1983, the briefs of accidents that you have been accustomed to seeing will no longer take the old format. They will be in a format where you can read a 200-word narrative. You will also see a sequence of events that led up to the accident underlining the why. There will no longer be the canned phrases, continued IFR into VFR, failed to maintain flying speed, improper

level off touchdown, pilot lost control. We will be able to present to you, in a readable fashion, why the level off/touchdown was involved, why the pilot failed to maintain flying speed. These are the goals that we have set out reach.

I can assure you that we are going to reach those goals one way or another. One aspect of the general aviation accident investigation is the field investigation portion of the job. The other is the development of the safety proposal based on the findings during the investigation. I do not think you have heard the words "safety proposal" mentioned thus far in our program. The main reason for it is that the safety proposal is developed by the field investigator.

Here again, the field investigator has this tool available to him, to develop what he feels is the safety correction which should be taken into consideration. The safety proposal is developed by the field investigator covers the scope of aviation and aviation activities, which includes operation, aircraft performance, avionics, components, communication, scheduling, weather, maintenance and the list could on.

When the field investigator's safety proposal arrives here in the Washington Headquarters it is assigned to a specialist in the Bureau of Technology for further study and evaluation. Based on the merit of the proposal it has two routes. It is either rejected or is developed into a safety recommendation.

The intent is not to manufacture safety proposals on a production line basis, but to encourage each accident investigator to transmit his or her thoughts concerning potential safety hazards in an open and unrestricted manner.

Of course, we reject many more of these proposals than we develop in recommendations. To give you an idea of our recent record in the field with respect to safety proposal and recommendation program, in 1981-82 there were 157 proposals suggested by field investigators for the improvement of general aviation safety. Of that 157, there were 149 recommendations developed and submitted to the Federal Aviation Administration. That sounds like a pretty good track record. But you must understand that one safety proposal may develop into as many as five or six recommendations. That's why the number between the total number submitted and the total number of recommendations is so close together.

During 1983 we hope to increase significantly the number of recommendations both to the Federal Aviation Administration and to the manufacturers of general aviation aircraft as we identify safety issues with our investigative procedures and the use of our new computer system.

During the past 2 years we have worked very closely with the aviation industry on many of our mutual problems and concerns. For an example, a cooperative effort involving the recent meeting between the industry and government concerning the practicability of standardizing and modifying nozzles and tank openings throughout the fuel distribution system from the refinery to the airplane, so that jet fuel could not be inadvertently delivered to a tank intended for containment of aviation gasoline, or that reciprocating engine powered aircraft could not be inadvertently refueled with jet fuel.

Some 22 organizations and organizational groups were contacted in the initial phase of addressing this problem. We are extremely pleased to announce today that industry has responded tremendously to the solving of this long standing problem, and hopefully, before the end of this calendar year the possibility of misfueling an aircraft will be history.

While on the subject of government and industry and cooperative efforts associated with aviation safety, I would be remiss if I did not mention the recent ultralight vehicle accident investigations. As you know, the emphasis in government has been to deregulate or to industry subregulate. In the case of the ultralight vehicle, the FAA determined initially that it would not regulate the ultralight or certify its operators. The idea was to encourage the ultralight community to develop its own safety program.

While the Safety Board is pleased with this approach, and applauds the word of the Aircraft Owners and Pilots Association, the Experimental Aircraft Association, and the Ultralight Manufacturers Association, we also must consider the welfare of the general public. To assess the effectiveness of this endeavor the Board will investigate a limited number of ultralight accidents to keep abreast of emerging safety problems disclosed by those accidents which we investigate. Hopefully, we can be of help to a new industry, and eventually work our way out of that part of our job.

I certainly would not want to mislead you if I did discuss in part the parties to the field investigation. This morning you were told in detail about the responsibilities, who could be, who could not be parties to the investigation as far as the field investigation with respect to general aviation accidents. However, I would like to leave with you a few thoughts and guidelines that each of our field investigators use when they designate parties to the investigation when there is probably only one man from the NTSB, one from the FAA and whoever else that the IIC decides that he would like to designate as a party to the investigation.

The rules are a bit more informal than you would find on a catastrophic Go-Team that was discussed with you this morning. The field investigator uses the following guidelines to determine whether or not there are going to be parties to the investigation.

The first one that he considers is the need for parties. Remember that by law the FAA is always a party to the investigation.

Number two, what expertise is needed?

Three, where is this expertise available?

Four, what is the response time of the organization giving the expertise?

Five, ensure compliance with the National Transportation Safety Board's Regulation Part 831.9, of which you have a copy. That is not the full list. There is one more that we must make sure that each and everyone of us understands. The final one that we must all be aware of, the investigator in charge, in this case the field investigator, is the final authority to designate or to not designate parties to the field investigation.

For many of you my remarks today are probably one of how we are going to achieve our goals without bringing more of the Washington big brother into the picture. We at the National Transportation Safety Board have no intention of incorporating the big brother syndrome. We recognize that general aviation is a complex and diverse industry, serving a broad segment of the public.

General aviation pilots carry the mail, fights fires, performs ambulance duties, manage land and wildlife, performs air mapping, dusting of crops and transports over 235,000,000 people a year to over 14,000 airports that are not served by air carrier

industry. General aviation is also an industry that incorporates over 760,000 active pilots, 250,000 mechanics and other licensed ground personnel into a viable industry.

For many communities, general aviation spells economic growth and profits. For the nation it provides a means of business decentralization. It is my firm belief that our program at the Safety Board is to promote and assist general aviation activity, which will result in benefits for the industry. It is also my belief that the future of general aviation depends on the public confidence, a confidence that we can bolster through great emphasis on safety.

Ladies and gentlemen, I thank you very much for your attention.

James S. Smith
General Engineer
Bureau of Safety Programs

The published topic is the NTSB computer data system. I am going to focus down to the NTSB aviation accident systems. To set the stage a little bit, I would like to tell you what the Bureau of Safety Programs, or SP as I will refer to it, does for a living. We do not develop accident data or enter that data into the computer, and we do not have day-to-day management responsibility for the computer. Those functions are respectively with the Bureau's of Accident Investigation and Administration. The Bureau of Safety Programs receives data from the computer. We perform data retrieval, sometimes for our own use, put out the annual reviews, develop the data for the January press release, and safety studies when we have time. Most commonly, though, we are an interface between somebody who needs accident data and the data base itself.

We get requests from Board members, FAA, CAB, lawyers, universities, manufacturers, air lines, almost anybody, to the tune of usually 40 a week or so.

Now, to get to the amended topic of the presentation. I would like to discuss the aviation accident data systems. I emphasize the plural nature of the "systems," because up until a couple of years ago we had only one system. Now, as I will explain we have several.

In the late '70s NTSB began to recognize that our system was inadequate to support all the kinds of analysis that we would like to do. It was also realized that since the system was developed in the mid-1960s advances in computer technology far outstripped what we had been using at that time. We would achieve some significant benefits just by changing the way we worked with the data.

So at some point — I do not know the date — the Safety Board made a significant change. The aviation accident data system had been developed, originally in the CAB, and had evolved and matured through the Department of Transportation and the independent Safety Board. It was about to undergo a kind of revolutionary change.

Work began on defining the new system in terms of its parts; the data, the software and the computer equipment itself. Procurement of the computer hardware and software resulted in installation of the Digital Equipment Corporation, Model 20-20, computer at the Safety Board in December of 1980. Within a couple of months the aviation data system, which had been running on the Department of Transportation computer, was moved to our system, with no functional change.

It was implemented as a batch system as it had been on the DOT computer. Later that year, in August or September 1981, the system was brought online, and that was the first real advance in capability we had relative to the data system. This was accomplished by storing the aviation data files in a form acceptable to a general purpose data base management system that we use at the Board.

I imagine there must have been quite a jump in user-friendliness as a result of this change. For example, being on an interactive system instead of a batch system, you find your mistakes relatively quickly rather than waiting for the next morning or the next Tuesday morning, when you get results back.

A second benefit is that you could now extract data from the system by knowing the name or the "nicknames" of the data item that you are looking for rather than where it resided in the physical record within the computer.

As an example of that point, it is much easier to look for a registration number by saying "find number equal to N123" rather than to find N123 in characters 13, 14, 15, 16 of each data record. The old familiar batch software that was used by the Board to generate briefs, tables, and cause factor tables was converted to run on the new system in its batch mode, so now the aviation data system was a major user of a fairly powerful little computer, rather than just another cog in the big DOT wheel, vying for resources from the Transportation Computer Center.

I suspect things must have looked pretty good at that time, but there were some complicating factors in the works at that point. The intent of changes made up to that point was not just to make life easier for the data retrieval people; but rather to provide that benefit as well as make the data that was collected and stored more useful to the aviation safety community.

Two activities were underway at that time which supported the goal of increased data utility. The first was that a preliminary accident/incident and data system had been devised and in 1981 data was being stored in that system.

Number two, the Board's design of the revised full data system was nearing completion. The preliminary system was intended to contain much of the factual accident data that could be acquired and entered into the computer within 15 days.

Using that preliminary data base, questions could be answered as nearly up to the minute as possible. The only disadvantage from a data retrieval point of view is the need to learn another set of nicknames.

Of greater consequence than the convenience that was offered by the preliminary system was the new revised aviation data system. The philosophy and data forms for this new system had been developed by NTSB, and we thought they were coordinated with the FAA. However, in December of 1981, just before the new system was to go into operation we found out that FAA did not concur with the forms; they had not agreed to them.

Then we had to make a decision. The decision that was made was that FAA would continue to use the old forms, NTSB would use the new forms, and that FAA and NTSB would, in 1982, get together and come up with a form that was acceptable to everyone, and that is exactly what they did. When the FAA forms were received in NTSB Headquarters, our people recoded the data onto our forms, and everything went into the 1982 data base.

I should print out that the data base format had remained fairly constant from 1964 to 1981, but then in 1982 we began using the preliminary system and the new full form system.

The NTSB and the FAA worked together to come up with a new set of forms. Forms that were agreed upon finally were put into use in January, 1983, and everybody is using that form now. The new forms are sufficiently different from the 1982 forms that we have another new data base and another new preliminary data base.

So we have five data bases, two preliminary and three full, (1964 to 1981, 1982 and 1983 and future years). Any one of the data bases would be impossible to describe in detail in the few minutes available here, and I will not attempt to do that. I would just like to characterize the new data base, (1983) as a much more comprehensive description of an accident. In addition to the basic information that was entered into the old system, we have a number of additional items that are required, mandatory entry. A few of those that could be very useful are the regulations under which the flight was conducted, the pilot's certificate number, availability and use of restraints.

In 1980 we began reporting accidents by the regulation under which the flight was conducted. However, the regulation was not coded in the old forms. We had to deduce from what was in the record and/or the docket what regulations some of these accidents happened under. With the new system, we also have the capability to enter an accident narrative and a sequence of events. In addition to the core form which contains the basic data we have 21 supplemental forms. Four of these supplemental forms have been put onto the computer system, another seven are pending. I am told they all will be done this year.

As was mentioned earlier, there is a 6-month evaluation period that is in progress. I imagine there will be some fine tuning of the forms and the data system; changes will have to follow. We hope then that there will be a period of stability.

For the future we expect to upgrade the computer system later this year with equipment that is compatible in every way. The computer we expect to obtain is on the order of five or six times faster.

We have had some preliminary meetings with FAA regarding institution of a common (or combined or equivalent) data base, but that goal appears to be in the future. Our Bureau, SP, has requested that the Bureau of Administration look into the feasibility of putting up on our system, the FAA activity data base so that we can know by make and model, and by type of activity how much flying is being done.

In conclusion I would just like to make the point that a major challenge for us for the near future is going to be in answering questions that arise covering more than just one of these data bases. It is something we have not really had to address yet. Soon we are going to have to start answering questions using data from one, two, and ultimately three different data bases and trying to construct a unified story of what happened statistically over some time period.

That's all I have. Thank you.

John M. Stuhldreher
General Counsel
National Transportation Safety Board

This topic listed for discussion this morning is "Impact of Litigation on Accident Investigation." The word "litigation" is meant to pertain to all actions or suits for damages which grow out of aircraft accidents commonly the occupants of an aircraft (or their estates), as the plaintiffs or claimants, suing the operator, manufacturer or government, as the defendants. My remarks will not extend to other types of proceedings — e.g., criminal, enforcement, or company actions — which also impact the Board's investigations, but in a different way, and to a much lesser degree, than civil litigation.

Before getting to the specific ways in which litigation affects the Board's investigation, I would first of all like to state, in general terms, what the Board's posture is towards litigation and the reason for that posture. The Independent Safety Board Act of 1974, as well as the Federal Aviation Act of 1958, each provide that Board accident reports shall not be admitted as evidence or used in any suit or action for damages growing out of accidents. When this provision was included in the 1974 statute, the Senate Commerce Committee stated that its inclusion "evidenced a strong committee desire to keep the Board free of the entanglement of such suits." The term "entanglement" is, in my view, an extremely apt and descriptive word—it conjures up an image of the Board's investigation becoming intertwined with the tenacles of the litigation. It is therefore the Board's policy, as expressed in its regulations and practices which I shall discuss below, to maintain the litigation at an arms length distance so that we can complete our investigation as expeditiously and effectively as possible.

Perhaps the most direct regulatory reflection of the Board's posture towards litigation is the provision in both Part 831 and Part 845 which states that a party to the field investigation (or a party to the hearing) cannot be represented by any person who also represents claimants or insurers. This provision is based on the premise that the claimants and insurers are the principal parties in interest in the litigation and participation by their representatives in the Board's investigation would necessarily result in an "entanglement" of the two proceedings. The claimants' representatives, in particular, often complain that being denied party status in the Board's investigation puts them at an unfair disadvantage in the litigation because the defendants (the operator, the manufacturer, and government) are parties to the investigation and thus have earlier and more direct access to the evidence. Our answer to this contention, which we are constantly faced with in Court actions, is that the reason parties are designated to our investigation is not so that they can protect their interests with respect to pending or prospective litigation but rather that they can technically assist the Board in determining the facts, conditions and circumstances surrounding the accident. We also emphasize that the Board's entire investigation is carefully documented in a record which is made available to the public and that the Board's investigators are made available for depositions by the litigants. This approach represents, in the Board's view, a reasonable balance between assuring an investigation free of the adversary overtones of litigation while at the same time providing reasonable access to investigative information to those parties not allowed to participate in the investigation.

Application of the Board's regulations concerning parties is relatively uncomplicated in major investigations where various companies, organizations, and agencies (and their representatives) who generally participate is well defined by tradition and practice. General aviation accident investigations conducted by field office investigators are another matter. The investigator is often confronted with a number of questions such as: should the owner/operator be considered a legitimate party or a claimant? Is the person who appears at the scene on behalf of a manufacturer or operator actually representing those parties or does he in fact represent the insurer? Ultimately, the investigator, who is given considerable discretion by the rules, will most likely base the matter of party designation on need. I might point that there is no requirement that there be any parties to the investigation other than the FAA.

One point, early in the investigation, when the litigation affects the investigation is when we seek to obtain the testing of parts and components. On a number of occasions, investigators have been delayed because claimants have sought to restrain the testing, particularly when it is to be done at the facilities of manufacturers or operators. The claimants argue that it is unfair that parts will be tested, and perhaps altered or even tested to destruction at the facility of the defendants when they (the claimants) will not be allowed to be present. Again, our anser is that the Board directs and observes the tests, documents and makes public the results, and the parts are returned to the owner or insurance company. Sometimes the matter is resolved by shifting the testing site to an independent facility or to the Board's own laboratory in Washington. In some instances, however, the testing must be done at the site of the manufacturer since it is a "one-of-a-kind" facility. Where this was true in one recent investigation, and attempts to lift the court order were unsuccessful and an agreement among the litigants could not worked out, the testing was never done.

The Board also sometimes runs into problems when we attempt to return wreckage components and other evidence (such as aircraft records or pilot logs) to the owner or designee, often the insurance company, which is our standard procedure once the investigation is completed. Claimants on occasion request the Board, or seek a court order to compel us, to retain custody of this evidence, which they claim might be altered or lost if returned to the owner. Absent a court order, we adhere to our procedure, one of the reasons being that the Board does not believe we should be cast in the role of custodian of evidence for the litigants. For the same reason, we resist requests from litigants to preserve all investigator's notes and materials of any type prepared or gathered during an investigation. Again, it is our function to compile information, not for purposes of litigation, but rather to complete our investigation.

Perhaps the most significant impact of litigation (or potential litigation) on the Board's investigation, but one which is extremely difficult to measure, is the restriction on the flow of information from the parties to the Board. Although we expect parties to participate with the interests of the Board's investigation uppermost in their minds, we are not so naive as to overlook the awareness of the parties and their representatives of the litigation. Can we reasonably expect the parties, particularly where there is no request or where the request may not be specific, to volunteer information which will help the Board but which would adversely affect that party in the litigation? As a general matter, information sought and furnished during discovery in litigation exceeds that obtained by the Board during a normal investigation. We do not believe that this disparity is something we should always be concerned about because of the difference in purposes in the two proceedings and in view of the greater resources and time expended by the litigants in the process of digging for information. We must nevertheless ask ourselves the question, should we seek more information and, if so, how?

Any document which comes into the Board's possession during an investigation becomes subject to the Freedom of Information Act (FOIA) and unless a particular document comes within one of the exemptions to that Act, it must be disclosed pursuant to an FOIA request. Any party which supplies data which it considers to be a trade secret should so advise the Board since there is an exemption for such information. The Board was also given some relief from the FOIA in the form of a recent statutory amendment which directs the Board not to disclose the cockpit voice recorder (CVR) tape and to withhold the CVR transcript until the public hearing or 60 days after the accident, whichever occurs first. The legislative history of this provision, however, makes clear that these restrictions were not intended to affect Board use of CVR information for recommendations or sharing CVR information with parties to the investigation. The FOIA exemption most commonly asserted by the Board is one which pertains to intra-agency memoranda (usually the investigators' analyses) and thus does not apply to information supplied by the parties.

The entire matter of obtaining information also poses a problem in foreign accidents, in which the Board commonly participants as an accredited representative in accordance with the provisions of Annex 13 to the International Civil Aviation Organization (ICAO). The Board's investigators often have access to evidence in the form of documentation which is needed for accident prevention purposes, not only by the Board but also by the FAA, manufacturers and operators who serve as advisors.

Litigation, of course, arises from foreign accidents just as it does from domestic ones. When the Board is approached for information by claimants, we tell them it is not our investigation and they should communicate with the State conducting the inquiry. However, foreign States generally do not furnish any information until their investigation is completed and they may be in no rush to do so. As a result, the claimants may turn to us, in the form of more formal requests (such as under the FOIA), and our present posture is not a secure one. Some years ago, in connection with the Paris DC-10 crash, the Board was compelled to produce documents, much to the consternation of the foreign government. There currently is no exemption to the FOIA which applies to such documents. Because of our vulnerability, our investigators are instructed to bring back no documents from a foreign investigation, which severely handicaps our ability to fully carry out our responsibilities. In addition, the United States government was recently compelled to file a difference to section 5.12 of Annex 13, which restricts disclosure of certain records gathered during an investigation, pointing out that because of our laws, we might not be able to comply with that provision. I might add that the U.S. is not alone in this position — nine other countries also filed differences to section 5.12.

The public hearing phase of a major investigation is another point where the impact of litigation is felt. In several instances, attorneys representing a group of claimants (Chicago DC-10 accident) or an association of passengers (Kenner, Louisiana) attempted to compel the Board to allow them to participate as a party to the hearing. The Board was successful in rejecting those attempts by convincing the courts of the merits of our rules and policies regarding parties. I want to emphasize, however, that it is vital to the success of our continuing effects in this area that the parties to the hearing participate in a manner which is not motivated by the litigation. The Board wants your help to develop a record for our use; we want questions which stem from your different positions to improve the record, but we don't want the "heavy hand" of litigation to appear to be the prime mover.

We have a similar concern about the manner in which parties participate in the nonhearing phase of the investigation. For example, our investigators sometimes receive

reports of testing from parties, admittedly infrequently, which are stamped "For litigation purposes only." We are also advised that when claimants seek certain documents during the litigation, the defendants (also parties to our investigation) assert the work-product privilege, thus indicating that the party's representative was participating in the Board's investigation primarily to gather information for litigation rather than to assist the Board. Although these occurrences are infrequent, they do serve to undermine the Board's ability to enforce our rules regarding parties.

Following the hearing, or the completion of the investigation in a nonhearing case, the parties have the opportunity to have an input into the Board's findings by submitting recommendations. In fact, although urged to do so, the parties, particularly those who are also defendants in the litigation (i.e., the government, operator and manufacturer), rarely submit recommendations. Whether this is in any way the result of concern over the litigation is a question which can only be answered by the parties.

The Board's investigation culminates in the issuance of the report containing the determination of probable cause. The impact of litigation with respect to Board reports takes the form of requests, by parties to the litigation, either to expedite the issuance of the report or to reconsider the Board's findings after they have been issued. These types of requests reflect that, even though the Board reports cannot be admitted in evidence, parties to the litigation are nevertheless anxious to have the Board's findings on their side, perhaps to give them leverage in extracting a favorable settlement.

The most important product of our investigations are recommendations made to other agencies or private companies to take corrective action to prevent the recurrence of accidents. Again, the effect of litigation on a party's willingness to take corrective action, whether or not in response to a recommendation, is difficult to measure and can only be answered by the parties.

The final and most practical impact of the litigation on the Board occurs long after the investigation is completed. I am referring to the requests, by litigants, for the depositions of Board investigators. The Board grants several hundred of these requests per year, and the number is constantly on the increase. When the time spent in preparing for the deposition, giving testimony, and reading and correcting the transcript following the deposition is all considered, the workload impact on an agency as small as the Board is substantial. Litigants also are prone to go into court to expand the scope of the investiator's testimony beyond that allowed by our rules, or to compel the investigator to appear at the trial. A considerable amount of time is expended in dealing with these problems, particularly by our legal staff.

In conclusion, I would like to quote from the remarks made by my predecessor, Fritz Puls, in addressing a similar gathering at Downinton in 1975. He summed up with the following observations:

(1) Until this country adopts a no-fault system for aviation accidents, which will extend to all potential defendants, litigation will tend to have a major impact on accident investigation.

(2) There is no question that its impact has been increasing each year in direct ratio to the general increases in the number of negligence actions being initiated.

(3) The most tangible impact at the moment is the delay which litigation problems create during the investigative process. The less tangible, which is difficult to measure, is undoubtedly the most significant.

(4) The problem undoubtedly will become worse before it gets better.

(5) We await any suggestions you might have which will diminish the problem, but withhold any expectation that there is a magic formula to alleviate the problem.

I think these same observations apply today, 8 years later, and I would surmise that they might still apply 8 years (or even further) down the road.

SECTION II

AVIATION INDUSTRY PANEL PRESENTATIONS
PANEL ISSUES

Washington "GO-Team Major Aircraft Investigations "A Critique"

General Aviation Accident Investigations - "A Critique"

Use of Recorders and Aircraft Performance Studies
in Aviation Accident Investigations - "A Critique"

Human Performance/Human Factors in Aircraft
Accident Investigations - "A Critique"

ISSUE: Washington "Go-Team" Major Aircraft Investigations - "A Critique"

Panel 1:

Moderator - Gerald T. McCarthy, Aviation Accident Division

Captain Louis M. McNair	Air Line Pilots Association
Barry L. Trotter	Eastern Air Lines
John W. Purvis	Boeing Commercial Airplane Company
John D. Rawson	Federal Aviation Administration
Richard Collie	Regional Airline Association

Panel 2:

Moderator - Stephan J. Corrie, Aviation Accident Division

Captain Ronald M. Sessa	USAir
Captain Douglas Twynam	Delta Airlines
Steve R. Lund	McDonnell Douglas Corporation
Robert L. Hale	Federal Aviation Administration
John T. Moehring	General Electric

Captain Lou McNair
Air Line Pilots Association

On behalf of my fellow ALPA participants and myself I would like to take this opportunity to say how glad we are to be here. My thoughts go back to the Downingtown meeting of 1975, held after the longest hearings in NTSB history. I am not sure whether my appearance here today is to forewarn you of the future or an attempt to prevent a recurrence of past mistakes.

In either case, I would take this opportunity to congratulate the NTSB on convening such a forum. Those will probably be the last kind words I will say.

I am going to walk you through an accident investigation from field investigation through, yes, even your favorite subject, a petition for reconsideration, pointing out our areas of major concern with specific accidents as examples.

First for the field investigation. A classic case is the PSA midair collision case. We still see a failure to examine all available data. To fail to obtain and publish such important information in the original blue cover report is not to do the best job possible. Consequently, ALPA filed a reconsideration of probable cause in this accident.

Possibly because of over reliance on electronic data collection, qualified witnesses are not being interviewed properly. Two classic cases are the jump seat rider in the Delta/Flying Tiger O'Hare near collision, and the passenger in the Convair 580 Kalamazoo accident on North Central, a passenger who was a qualified engineer.

We believe in some cases that there has been a premature release of wreckage. Again we cite the North Central in Kalamazoo. Such release will forever give problems in the item of determination of the amount of rudder available to the captain in that accident.

We realize the Board's concern for compliance with the provisions of the Freedom of Information Act. In the conduct of press relations in the field we feel that the Board is going beyond both the letter and the spirit of the Act in making available to the press the minutest details of the investigation.

We continue to see FAA interference with the investigative process by their untimely use of their powers of sanction. In the recent Frontier B-737 gearup landing at Caspar, Wyoming, the crew agreed to talk to the NTSB with the FAA not in attendance. This procedure is long established and it is the subject of an agreement between NTSB and DOT. In the Caspar case, the FAA threatened an emergency revocation if the crew did not allow an FAA representative into the interview.

In the Southern 242 case in New Hope, Georgia, notices of investigation were sent to numerous pilots that were flying in the same area. These same pilots were later called to testify at the NTSB hearing. In the Prinair St. Croix accident, over 40 violation notices were sent to Prinair pilots during the course of the NTSB hearing.

We agree with the Administrator's mandate under the statute to provide for aviation safety. We realize that in certain cases it may be necessary to file a violation. However, we also believe that accident cause determination and prevention are more important than sanction application. Simply stated, in many cases the timing of the administrative sanction is poor and tends to retard the process of cause determination.

Turning now to the crew interview subsequent to an accident. If this interview is to be truly informal no recording devices of any kind should be allowed. We have had such recordings later put forth as a crew statement, which they were never intended to be. It has been stated that if the crew does not give an interview, they will face a deposition. We will accept that challenge if you will give us some rules for deposition hearings. Current conduct of those proceedings is far too nonstandardized between hearing officers. As a start, we would propose the same rules as those used in public hearings. Proposals for rules and procedure in deposition could be a work project for a joint industry/NTSB working group.

Turning now to public hearings, we find members of the Board have different procedures as to the number of rounds of questions each party is allowed to ask. To propose standardization in that area would two rounds of questions be sufficient, with only new area allowed in the second round? Hypotheticals to crew members are unfair. You are asking another professional pilot to arrive at the same point in life, that is, death. If the Board, for some reason, need to determine what other pilots have done in the same circumstances why use those that were near the accident scene? Why not truly randomly survey pilots?

The timing of the public hearing is at best difficult. We do have a problem with expert witnesses who arrive at the hearing only to say that they have had insufficient time to prepare. An example of this is the recent PanAm 759 hearing in New Orleans. Almost as bad is the arrival of the expert witness at the hearing with a mass of data to be distributed at the last minute to the parties with the resultant lack of effective questioning.

Too many public hearings have actually been press hearings with a little public scattered behind the cameras. Some control must be regained over this situation. A pool of cameras might be a solution to the problem.

The most contentious point in accident investigation is analysis. We firmly believe that a better work product will result and fewer petitions for reconsideration will be filed if the parties are allowed to participate in the analysis process prior to the publication prior to the publication of the Board's final report.

We would suggest three areas of improvement. One, the technical review currently conducted could be expanded to include analysis. Two, the perusal of a draft report by all parties could go a long way toward preventing the necessity of filing petitions for reconsideration. If it possible to keep a CVR readout secure it should be equally possible to keep a draft report secure.

Third, the Sunshine Act meeting could become participatory by parties. This would give the Board the opportunity for the best accuracy in determining the probable cause. Often in Sunshine meetings or in reviewing the transcript of Sunshine meetings ALPA representatives have sat in the audience with a total sense of frustration in being unable to correct erroneous statements that were being made by members of the Board or staff. Specific examples of such accidents are the Reeve Aleutian and PSA accidents.

It is appropriate at this time to again speak for the concept of all cause. Much was said concerning this in the ALPA seminar held in December, 1981 here in Washington. ALPA believes that the Congress, the Board, the industry and the public are mature enough to accept such a concept.

Staying on the subject of cause, we again must protest the idea that makes the pilot the cause of last resort. That is, if no other cause can be found it must have been the crew's fault. The Board should be very conscious of those cases in which one or more Board Members do not vote on the adoption of the report. In one of the most contentious accidents in history, TWA 541, two Board Members did not vote. One voting Board Member filed a strong dissent while still adopting the report. In our opinion, we have on the books a report with only 2-1/2 votes for. Hardly an overwhelming majority. TWA 541 is not a dead issue with the Air Line Pilots Association.

In all of the Board's work a sense of timing is important. However, in no case should quality be sacrificed. All accidents have their peculiarities. It is impossible to set up inflexible guidelines for the completion of the various phases of an investigation. Any time the Board needs more time to ensure a quality product, ALPA will wait.

Now to the Board's favorite subject, petitions for reconsideration. Someone said that ALPA always files a petition for reconsideration. Since the formation of the NTSB on April 1, 1967, ALAP has participated in 256 investigations as an interested party. We have filed nine petitions for reconsideration. A percentage of 3.5 is hardly overwhelming.

The petition for reconsideration cries out for the privilege of making oral arguments to the Board. The Board has flirted and danced with this for some time. They have even allowed a videotape. Why the reluctance? A few miles to the northeast stands the Supreme Court of the United States. It is the highest court of appeal in civil and criminal cases. You, the NTSB, are the highest court of appeal in determining the cause of aviation accidents. Imagine the Supreme Court without argument. Certainly a sterile environment, and not the best way to get to the truth. Oral argument has the benefit to the Board of the Board's being able, by sharp questioning, to tear apart the particular petition and with it the petitioner. We accept that challenge.

In closing, I want to again thank you for the opportunity to appear. I again want to depart on a positive note in stating that we have noted many positive changes in the Board, particularly, quite frankly, since the introduction of the new Chairman of the Board, the Honorable James Burnett.

We applaud you for those changes that you made, we accept the new spirit of cooperation, and if you simply by fiat clear up all the past mistakes that we still have on the books, we can continue forward together. In closing, for a governmental agency to convene such a forum as this is just plain gutsy, and it has been my pleasure. Thank you.

Barry L. Trotter
Eastern Air Lines

I would like to, in getting started here, congratulate the Board on putting together a group like this for the purpose that we are all here today. They deserve congratulations on that.

Historically the Board has welcomed and encouraged the active participant of major air carriers to assist in the investigation of the air line accidents. The reasons for this are not hard to understand if you consider the complexities of unraveling the nuts and bolts and logic of many air frame and power plant systems that makeup our air carrier transport aircraft. Air lines have responded positively in this need and have developed Go-Teams who are ready to respond on short notice. These accident investigation teams consist of representatives covering the entire air line management spectrum from dispatch and customer services to flightcrew training.

Critical to these teams are the air line engineering and technical experts who are specialists on the type aircraft structures, the power plants, avionics and mechanical systems. Some air lines, such as Eastern, have developed a formal air line emergency procedures manual which outlines the overall and specific responsibility of investigation, recovery and public communications.

At Eastern the Senior Vice President of Operations Services is placed in charge of the air line's investigative operations, and the Management of Flight Safety acts as Chairman and coordinator of the accident investigation team. This coordination of tasks carries the responsibility for the coordination and control of all formal communications, requests and reports relating to the field investigation.

This manual also provides the names of the individuals assigned to the specific investigation committees and defines the duties and responsibilities of each. The air line accident related tasks are initiated well before the accident team is called for. Depending on the location of the accident, the local sales and service manager is responsible for establishing a field operation office at the scene, including telephone communications. In addition, he must compile the names and telephone numbers of all associated, medical, fire, rescue and police agencies, funerals, homes, hospitals, etc.

The guarding of the aircraft wreckage and the U.S. mail is also the air line's responsibility until the NTSB is onsite, and a U.S. Postal Service official arrives. A command center is set up at Eastern's home base in an area of the company known as System Control. All investigation team members meet there to receive a status report and to check in for their assignments.

The specialists who are assigned to the various NTSB committees for field investigation are then sent directly to the accident site. These team members work under the auspices and direction of the NTSB investigator-in-charge. The flight recorder committee members report directly to NTSB laboratory services at Washington.

There are a multitude of other priority tasks to be accomplished away from the accident site. This includes the gathering and compilation of a passenger list and next of kin. This is not as straightforward as it might seem, and the preliminary figures are often inaccurate. This is due, in part, to the urgency of the need and the time lag that exists for updating company computers.

One of the other major non-field related investigation tasks involves gathering up all of the maintenance records associated with the accident aircraft's component systems and engines. Similarly, the training and duty time records of all cockpit and cabin crewmembers are compiled for release to the Board. These investigations are extremely difficult and painstaking under even the most ideal conditions.

In the past, performance of the Board has been credible. We feel that in most cases the Board has remained openminded to inputs and recommendations from interested parties. The Board investigators have generally recognized and relied heavily on the assistance and expertise of the air line and aircraft manufacturers' technical and performance specialists.

However, as in any undertaking of this magnitude there is always room for improvement. I would like to take this opportunity to voice some observations from air line viewpoint that relate to potential areas of improvement.

The first area I will comment on is the field investigation. The technical expertise and the analytical resources available to the NTSB are probably the best in the world and, accordingly, are more than adequate for the task of determining probable cause. However, we have at times felt that the investigation was hindered or delayed due to lack of full two-way communications and cross-utilization of findings between the Board investigators and the airline/aircraft manufacturers team members. Understandably, the preliminary findings must be kept confidential until analyses are completed, but all team members should have full access as active participants.

What frequently happens is that the resources of the airlines or manufacturer's experts on committees are not effectively utilized, thus extending the time required to reach a valid probable cause conclusion.

The publicity aspects of the field investigation are another area of concern to the airlines. We feel that there is a critical lack of sensitivity to the potential impact of the airlines when preliminary information is released to the press. A recent example of this was our 727 gearup landing at Miami International Airport in February of this year. The Board's press release was issued at the same time the newspapers were full of the Eastern IAM mechanics strike threat coverage. The stated findings of loose bolts led to the obvious conclusion by many that the mechanics caused the loose bolt situation.

The press release should have clarified that these particular bolts had been found loose on other aircraft, and that there was reason to suspect that it was intentional. Innocent, but damaging to ticket sales and the financial well being of any company.

The use of the cockpit voice recorders and flight data recorders has already been a controversial issue. While we totally subscribe to their use as invaluable investigative tools, we believe that their value and effectiveness in aiding an investigation could be enhanced. In general, we feel that the Board technicians analyzing the recorded information are well qualified and understand the limitations and tolerances of the recording systems and the resulting readouts. However, once a readout or a plot is completed and passed on to the investigator-in-charge the data is often considered to be 100 percent factual, and further input from the lab technician/engineer is unnecessary. The end result is that the interpretation required to support the analysis of the data is absent.

A prime example of this is the altitude recording during landing. The Board laboratory engineer knows and fully understands the effects of the increase in air pressure below 50 feet precludes using this parameter for calculating rate of descent during the time period. Yet, time after time the final Board report overlooks this important factor when concluding final rates of descent. Innocent, but damaging to investigation and credibility.

Recent changes in the law regarding the handling of cockpit voice recorder information concerns us greatly. We feel that the Board's interpretation as implemented in their accident investigation manual is unduly restrictive and will deter the ability of even their own investigators to effectively utilize this extremely valuable information. We urge the Board to reconsider this new policy, as we feel it will indirectly lead to quantum in rehearing conditions based on charges of inaccurate readouts.

The last area that I will comment on relates to the value of the determination of probable cause findings. We feel the need for all parties involved to examine the objective of these findings. It is not enough to find that the flightcrew failed to arrest the rate of descent, resulting in the aircraft striking the ground. Obviously, the crew did not intentionally drive an aircraft into the ground. They may have a training problem or a medical problem.

We strongly urge the NTSB to more fully focus their efforts and recommendations into the human factors aspect. We feel that the full resources of the NTSB should be applied to the relatively large percent of the Board investigated accidents that fall within this category.

The determination of probable cause must be of sufficient depth to enable a valid recommendation that would prevent a recurrence.

John W. Purvis
The Boeing Commercial Airplane Company

As a relative newcomer to the field of accident investigation, I thought it necessary to call on others who have worked NTSB investigations to assist in preparation of this paper. Therefore, the contents are, as they should be, based comments solicited from throughout the Boeing Commercial Airplane Company. Of course, my own thoughts and those of my staff were also liberally used in assembling this paper. In supporting the NTSB during accident investigations over the years, many people from within our Company have participated in the investigative phase, the analysis process and other supporting roles. These are usually design and research engineers, operations personnel and pilots who will ultimately be involved in any design or operational changes which might result from an investigation. As "outsiders," brought in only to support the occasional accident, their comments should merit attention because they are the suggestions of people who not only participate in an investigation, but who also must use what the NTSB produces.

First, some praise is in order. In general, the people we asked for comments had no specific criticism of the NTSB. Frequently, our contacts indicated that the NTSB procedures and processes were thorough and the methods of handling investigations professional. But we did manage to come up with some suggestions and it is those areas which you asked us to talk about today.

Of the comments we received I have selected a few very broad categories on which to concentrate.

In recent years the majority of the accident investigations with which our company has been involved have been outside the USA and usually involved overseas operators. Several areas of these investigations caused difficulty for us. We realize that the NTSB usually participates in an overseas investigation by invitation as the USA accredited representative; however, it appears that the NTSB could use its influence to assist in making the overall investigation smoother and more complete.

1. Timely notification is an area which can affect all investigations, not just those overseas, though it becomes more of a problem with overseas accidents. Our office often learns of an overseas accident before the NTSB does because of our extensive network of field service representatives. This information sometimes comes at night or on weekends and holidays and we'd like to let you know as soon as possible but we have no reliable method to reach a "go team" member directly. The current answering service is somewhat less than adequate. The answer to this problem is not readily apparent but regular revision and distribution of an NTSB phone list which includes information for off-hour contacts would be a step in the right direction.

2. Getting to an overseas accident scene on a timely basis also poses problems. Our people have experienced delays of 1 or 2 days getting into some overseas countries because of visa requirements. As a result, we can miss some of the more valuable portions of an investigation. Assistance from the NTSB in this area using NTSB status as a government agency may be possible and surely would provide easier access to certain parts of the world.

3. Feedback from an overseas accident investigation is slow at best and sometimes nonexistent. We assisted the NTSB during the Far Eastern Airlines 737 accident in Taiwan in August of 1981. At this writing the English translation of the final report is still not available, although the Chinese version was reportedly forwarded through channels in early March. This problem becomes more acute when the manufacturer goes to an accident scene where the NTSB does not participate, and it becomes worse yet when neither party goes, but where we require information or findings after the fact. One reason for our interest in current information is to answer the many questions we get from our customers. They look to use for up-to-date information on accident investigation progress, especially on overseas accidents. On the other hand, it is useful to have the NTSB as a buffer between the manufacturer and the overseas accident investigation authorities who, in some instances, tend to request information and studies well beyond the usual limits of investigative needs when they begin working directly with the manufacturer.

During the initial investigative phase, the cooperation and coordination between the NTSB and the participating parties is usually excellent. However, once the groups break up and go their separate ways the flow of information to the parties becomes slower and we start hearing of progress and getting details through other sources. For example, we obtained our first copy of the PAA/MSY final report from an individual within Boeing who had in turn received it from another non-NTSB source. A few days later we got another copy through an NTSB source, which was appreciated; however, our "official" NTSB copy is yet to be received. On another accident, a recent 727/MIA gear up landing, we first heard of the NTSB safety recommendation through the national news services. We think the NTSB should provide information to the principles earlier and more directly. Further, the NTSB should provide data to the manufacturers as soon as possible, even in a preliminary form, before final recommendations are released. Even during the investigative phase, hard data such as fracture specimens, flight data recorder readouts, ATC transcripts and other findings should quickly be made available to the manufacturer so that any necessary corrective action may begin as soon as possible. The manufacturer can begin to develop and release changes or make modifications more expeditiously if appropriate technical proof has been examined first-hand and agreed to by responsible management.

FDR readouts were mentioned as one piece of hard data required early. It is important that accurate, agreed-upon FDR readouts be made available as quickly as possible to minimize speculation and help provide firm answers regarding airplane performance. This would help avoid revisions to analyses, which is a hardship on the technical organization doing the work and also delays final results.

Finally, on this subject, we firmly believe that the NTSB would be well served by producing conclusions and recommendations which are not only well thought out and technically accurate, but presented in such a way that the FAA, airlines and manufacturers can respond effectively. The recommendation released following the 727/MIA gear-up landing investigation is a case in point. At the time of the investigation and as a result of postinvestigative analysis and testing at Boeing and further testing on the airplane at MIA we are convinced that the subject covered by the recommendation did not prove to be the cause of the gear hang-up. In this instance, more coordination, testing and patience could have led to an improved recommendation. We would also suggest that the NTSB spend additional effort in analyzing the eventual impact of their

recommendations prior to releasing them. Releasing recommendations which are based on incorrect conclusions or which ask for too much may result in no action. Perhaps an informed review committee could established to realistically evaluate the impact and cost of NTSB recommendations as well as suggesting alternative actions which might be more effectively incorporated. The UK AIB uses such a process quite successfully.

The NTSB Accident Report Forms as of January 1, 1983, have been reviewed. In particular, supplements C Wreckage Documentation, Multi Engine Reciprocating and Turbine Powered Aircraft; I) Crash Kinematics: J) Water Contact Ditching; K) Occupant Survival and Injury Information; L) Seat, Restraint System, and Fuselage Deformation; and N) Fire/Explosions were examined. It was found for the most part these supplements provided an in-depth description of the subject aspects of the accident. Completion of these forms would provide a very detailed description of the accidents. The following suggestions might provide some additional information.

In anticipation of advances in crash dynamics technology arising from the on-going NASA/FAA research program, the NTSB might consider including additional information on existing forms. The use of flight simulation in conjunction with flight data recorder and air traffic control radar may give some information on the aircraft condition during the critical time period. These results should be included in the final accident report and identified as to source.

In supplement K, Occupant Survival and Injury information, a more quantifiable assessment of the injury, e.g. the number of sutures required for each injury would provide a better indication of the severity of the injury. This question surfaces when the hazard of jagged metal/material is mentioned.

In supplement L, Seat, Restraint System and Fuselage Deformation, more information on the condition of floor beams and seat tracks should be documented, particularly when some rupture has occurred. More information on the nature of fuselage ruptures would also be of value. Involvement of splices/joints in these ruptures should be noted.

Two general comments are offered. First, the government under executive policy is disposing of dockets more than 5 years old. Some "classic" accidents are being lost in this manner. The NTSB should designate accidents of long term interest for permanent retention.

Second it would be helpful if some structural damage severity index were assigned to an accident noted in the accident report. It is frequently difficult to determine the severity of the accident without a laborious search of the data. An example of such an index was given in NASA CR-1658491 DOT-FAA-CT-82-86 "Commercial Jet Transport Crashworthiness."

The impact of news media both during the investigative phase and, especially, at the Public Hearing detracts from an orderly and efficient program. The Public Hearing, in its present form, does not contribute to the accident investigation anything near what it should, considering the time and effort expended to hold it. Much of this is a result of media coverage and the kind of program it demands. This subject has been discussed many times before and there is no need to dwell on it here, except to make a few specific suggestions:

1) When the investigators are at work, access of media personnel to the immediate scene of the accident and to the areas where the aircraft is being reassembled or where parts are being analyzed should be more severely restricted, in order to prevent interference with the investigation.

2) The press briefing area should be as far removed as possible from where the investigation is headquartered and the headquarters area should be sealed off and secure so that only those people with a direct involvement in the accident are allowed to enter.

3) TV and press cameras should not allowed in the Public Hearing room or, if they must be there, then flood lights and flash should not be allowed and the cameras should be kept to the back of the room.

In summary, we think that an independent investigative agency is necessary to assure that the best in safety is the product of our mutual efforts. However, in our system of checks and balances, it is better to produce a product which has a better chance of incorporation than one which is idealistic but does not get accepted, and possibly even detracts from one's credibility. Through cooperation in all phases of the investigation a better product is possible. Meetings such as these are a big step in that direction. Thank you.

John D. Rawson
Federal Aviation Administration

I would like to preface my presentation with the fact that all of us here are interested in aviation safety or we would not be here. Most of us know I think what the NTSB requirements are, their statutory requirements, which are essentially to investigate, write a report, hold a hearing if necessary, and make a recommendation to prevent a recurrence.

I do not think a lot of people here know what are the FAA's responsibilities. We wear the black hats sometimes. But actually, the FAA, by mandate and Congressional charter is the only group that is not invited as a participant. We have to be at the accident investigation by laws so provision is made by the NTSB for us to be there to serve several purposes.

We have to determine whether or not there is a violation of Federal Air Regulations, whether the performance of the FAA facilities or functions was a factor, and whether the airworthiness of FAA certificated airmen, air agencies, air carriers, air taxis, and so forth, or airports are involved, whether the Federal Air Regulations were adequate for the condition, whether or not the airport certification safety standards operation were involved, and finally, whether the air carrier or airport security standards were involved.

Those same statutes that I mentioned do cover the fact that we have to have timely notification so that we can be there at the time of the investigation. In cases where the Board is conducting the investigation, parties are invited at the NTSB discretion, as you well know. Due to a Memoranda of Agreement between the DOT and the NTSB there are several things that the FAA has to do, or has agreed to do.

One of these has been mentioned earlier. We furnish the FAA aircraft to go to the scene of the accident. In addition, by FAA regulation, and by a Memoranda of Agreement, we are delegated to certain accident investigations.

Due to the fact that we have the responsibilities that I mentioned earlier you can see that there is a need for us to be there, and the express purpose for us to be there is corrective action that is needed immediately the FAA must take that action. That is not in any way to interfere with the Board's determination of probable cause.

It is well to note, I think, that FAA sometimes is under scrutiny, and sometimes we get our wrists slapped, too, as part of the investigation procedure and probable cause determination.

A lot of people do not realize that there are two investigations that actually occur concurrently, two government investigations, for the reasons that I have just mentioned, and for that reason we are modifying some of our instructions to our people to let them know that there is an FAA, IIC, although we are subordinate to and are coordinators with the NTSB when they are conducting the investigation.

There are some areas that I would like to mention that we are having some problems within FAA. One of these is incident investigations. Now, as you probably know Part 830 mentions five incidents which the operator is required to notify the NTSB. There are

many other incidents, as you well know, some that the NTSB, for reasons of manpower and so forth, or from the standpoint of interest maybe do not investigate. The FAA participates in 100 percent of all accident and incident investigations, whether we actually go to the scene or not. A data base that reflects the incident investigation is in Oklahoma City, and is available to everyone for their use. Some of our problems in incident investigations are a lack of interest we see on the part of people involved. For example, when we have a live crew, it sometimes is very difficult to interview the crew. Maybe there is good reason why the crew will not talk to the FAA without legal counsel. However, what happends in a case like that is that an incident investigation which could well have been an accident it is sometimes a week before we can interview them. By the same token, the CVR is protected too, and there have been instances where the only lead to the incident cause or accident cause might well be on the CVR or by way of a crew interview.

We need to look at those areas. I am in no way trying to move in such a way that would hurt the crewmembers, but we have to have to access to factual data so that certain things can be done. The same thing is true with the recorders. Of course, once recorders are readout we fully realize that you cannot use that information indiscriminately, but certain information on the digital flight data recorder or flight data recorder needs to be available.

The same is true for records sometimes that are maintained by the operator. It has been our unfortunate realization lately that there are some carriers that, when the NTSB is investigating the accident, the records that are part of the NTSB investigation are held back and not given to the FAA. I can tell you that there are times when we need to see those records as to airmen or as to aircraft, and so forth, to see whether or not we have a problem.

A recent investigation involving a gearup landing was one that we particularly wanted to look into because there has just been another carrier that landed the same aircraft in Germany gearup. Our situation at that time - and the NTSB at that time did not investigate the one in Europe - our concern was whether or not there was a built in problem with the aircraft that required our attention, or somebody's attention, to correct, whether it be crew fault or whatever.

Many FAA corrective actions, by the way, occur in tangential areas, areas that maybe have nothing to do with the probable cause. For instances, an aircraft accident occurs and during the investigation we become aware of problems that have nothing to do with cause, — lighting on an aircraft, airport or what-not. In these instances we need to move into those areas, and we try to do that.

I think one of the things we want to do, we want to finally I think get to a position with all the new hardware and the new recorders, and ways of determining probable cause to avoid some of the problems that we had in the early days. One good example, and this is a true story, we sent a man one time down to Central America on an accident. He came back after 6 weeks. The aircraft ran into the side of a mountain and naturally, we had a big meeting, and all the chiefs and managers were seated around the table and they said what happened.

He said, well, the aircraft took off to the north, made a left turn and crashed into the side of a mountain. We said, well, we know that, but what did happen? He said, you know, that's worrying the hell out of me, too. In summary, I would like to say that

aviation safety is the number one priority of the FAA, and any time an accident or an incident occurs it is proof positive that we, somebody, needs to move. We want to work and continue to work in that area, and we hope it is with the cooperation of the aviation industry. Thank you.

Richard Collie
Regional Airline Association

Good Afternoon — It is my pleasure to be on the program of this National Transportation Safety Board industry meeting. It is difficult to critique a team of experts who are truly professionals in what they do, who are very knowledgeable in aircraft accident investigation techniques and procedures, and who through their efforts over many years, have made outstanding contributions to safety in air transportation. It is probably their expertise that is the basis for the one critique item the regional/commuter airlines have passed along to me. In addition, I wish to briefly discuss three other items that have a bearing on investigation of small airline accidents. These are not critique items in the true sense of the word, but they are important to small airlines with very limited staffing.

In discussing this meeting with a number of regional/commuter airline employees, who unfortunately have had experience with catastrophic airplane accidents investigated by the "NTSB GoTeam," only one item appeared to surface that could be considered a critique of the team's action. Maybe it is the result of a perception that airplanes operated by commuters are small and unsophisticated. Maybe not, but the fact that "Go-Team" members have arrived on the scene with preconceived ideas of causal factors and how long it would take to complete the field investigation does not contribute to fast, efficient, accident investigations.

This may be a common fault with any of use who have investigated or participated in the investigation of aircraft accidents, the truth is, preconceived ideas may and usually do start us off with a bias that channels our thinking in the wrong direction.

When an NTSB team member tells the airline representative later in the investigation, that NTSB team members, encompassing seven field working groups, had preconceived ideas when they arrived on the site, it is time for the NTSB "Go-Team" to critique themselves and approach the task of accident investigation without bias, preconceived ideas or undue outside pressures.

I remember a few years ago when a bolt found on or beside beside the runway, along with the subsequent publicity did nothing but impair a very complicated investigation. In order to properly do their job, NTSB team members must be isolated from sensationalism and political one upmanship, so they can go about their business of determining accident causal factors.

Now for the non-critique items that we believe should be looked at by the NTSB and considered by the investigator in charge. (IIC)

1. Permit nonairline employees, who are technically qualified, who can contribute to the investigation, and who are retained specifically for this task as a representative of the airline, to be assigned to and participate on field working groups.

2. Authorize nonairline experts, who have been retained to assist the airline accident coordinator to attend and participate in NTSB IIC meetings.

3. IIC should consider the need for improved communications with the airline accident coordinator if the airline does not have an assigned representative on the field working groups.

I am not trying to make a case for the retired NTSB person, who may be in the "experience for hire" business. But there must be a realization on the part of NTSB that small airlines, with very limited staffing, find it extremely difficult to assign six to eight people to the NTSB field working groups, assign an accident coordinator and handle the very heavy workload associated with catastrophic fatal aircraft accidents.

During the investigation of a recent commuter accident, the airline involved saw a need to retain a retired NTSB accident investigator to assist and advise their accident coordinator. Only through appeal to the Board member was it possible to get authorization for this person to accompany the airline accident coordinator and attend the IIC meetings. The authorization permitted the individual to attend but not to participate in the meeting. Participation, not just attendance, is essential for the small airline.

Plan ahead you say — have a plan of action, designate certain persons for specific tasks, know how you will respond to the many demands, This is good, but most small airlines find they cannot free up that many people for 2 weeks or so and still run an airline. Chances are the airline also will have lost some of its own employees which will make the task even more difficult.

NTSB Rule 49 CFR 831.9 states in part:

> Parties to the field investigation shall be limited to those persons, government agencies, companies and associations whose employees, functions, activities or products were involved in the accident or incident and who can provide suitable qualified technical personnel to actively assist in the field investigation.

This rule permits diverse groups to have representation on the field working groups, but interpretations received from NTSB would prohibit airlines from retaining, for instance, a technically qualified structures, for instance, a technically qualified structures, human factors, ATC, or weather, etc., expert to represent them on the field groups. It makes you wonder why, if the only objective is to determine the causal factors.

The small airline does not have the luxury of time when a catastrophic accident occurs, and must react as soon as feasible to correct any discrepancies that may have contributed to the accident. They need representation on the working groups, but you can easily see they may not be able to spare the people without bringing in experts to help them out in a high workload situation.

If they do not have representation on the field working groups, then the IIC must be aware that important information may not filter back to the airline coordinator, unless the IIC takes the time to improve communication and assure essential information is provided to the airline accident coordinator.

There are 242 regional/commuter airlines operating today and we believe the time has come to recognize the problems mentioned and change procedures or rules as necessary to be responsive to the many small airlines operating today. Thank you.

Captain Ronald M. Sessa
USAir

I would like to thank the Board for the opportunity to speak today, and I would like to thank all of the previous speakers for taking care of most of my speech. I think they covered just about everything, and I think after the last panel was up here I would like to thank God that I do not work for the FAA today. In any event, as I said, a lot of my material has been covered, and while I just think redundancy is great in the cockpit, at 4:30 in the afternoon maybe we do not need so much redundancy. I have kind of chopped my speech up a bit, but I wanted to touch on just a couple of things.

The first issue I would like to touch on one that is very near and dear to my heart. I do take a lot of interest in the media involvement. I think it is an area that I am going to be redundant in, and then I would like to just make a couple of comments about prevention as opposed to investigation, because it would be nice if none of us had to investigate accidents.

I think I have been directly involved in the investigation of four major accidents on our line, and I just say this as a matter of background only since we would all prefer not to have that experience. It seems that each accident brings a new dimension to our understanding of probable causes, and it should. But since we cannot wait for new accidents to increase our knowledge I think it is proper to commend the Board for sponsoring this type of a forum so that we can discuss and get more out of our experiences.

Our accidents in USAir have covered a wide spectrum. They have encompassed the simple instrument approach, too many eyes outside the cockpit, all the way to the complex situation of the undisciplined Superman captain who passed the first officer and a lot of things in between.

I have investigated two accidents as a member of the ALPA accident investigating team, and also two as the head of our Flight Department, and I would just like to share a few of my personal observations of those experiences.

I think the first thing that might come to mind when considering the thoughts of someone who has investigated accidents from both sides of the fence is whether the motivations are the same. That same question of motivation might also apply to each of the other industry and government people who make up the various committees on an accident investigating team. By motivation I am referring to that individual's or organization's desire to effectively investigate and honestly judge the facts in order to discover the true cause of the accident. Accepting the facts when they appear to point in your own area of interest may not always be the easiest thing to do, and some do it better than others. The purpose of my brief address is to simply raise the question in order that every person involved in an accident investigation might examine his or her own thoughts in this regard, so that there is no loss of experience due to what we all know as CYA considerations.

This leads me into another area of the subject today, and that is the Go-Team of the investigation itself. Again, speaking from my own personal observations I found that the NTSB members of this team were highly competent people who conduct their respective committee responsibilities rather orderly and in an objective manner.

However, I do feeal that the briefings that occur during the course of the field investigation are a facet of the investigation process that should be examined for the following reasons. Members of committees become thoroughly briefed as to the daily progress which can have both advantages and disadvantages, many of which we have already discussed here today. The advantages are obvious. Everyone knows where every facet of the investigation is each day, and that can be helpful in deciding whether to place additional emphasis in a particular area or not. But the disadvantages may not be so obvious. NTSB field investigators are professionals and appear to be well disciplined in the task of complete data gathering regardless of the fact that other data may be clearly pointing to a probable cause in another area. I do not truly believe that all the other members of the various committees are so inclined. They tend to get into the overall investigative thought process more than they should, to the detriment of their individual contributions to the respective committees sometimes.

The more people who know everything there is to know, the more the overall security and confidentiality of the investigation is compromised. I do not raise these points in order to be critical, but to identify what are probably normal human reactions to a set of circumstances. Too many knowledgeable people are vulnerable to the media, who would quite naturally like to help them with their expert speculation if you give them the chance. I am not advocating the withholding of information, but I guess I do take exception to those who would knowingly or unknowingly cause premature conclusions to be drawn through the media which could be detrimental to the investigation, and possibly cause unwarranted personal strife to crewmembers and/or their families. That is something that maybe many of you are aware of, but I an acutely aware of, and I do not like to see that sort of thing happen.

I would just like to pose a few questions to you on the investigative process, and then another area that has not been touched on here -- it is probably the only thing that nobody has talked about here today.

One question is, should the daily briefings include all members of the investigating team? And if the answer is no, who should attend? Another is, how much emphasis should be placed on requiring prior investigating experience or a reasonable equivalent in investigative education through seminars and such? And if we say there should be some education should that education be general or should it be confined to a specific area, for example, structures, operations, and so on?

That completes my list of questions on the investigative process, and the thought occurred to me that there is a lot of data available from a lot of investigations and with computerization of the information that we have available to us today that there is a possibility of defining a common thread. That would go a long ways towards accident prevention.

In addition to asking why in pilot error related accidents should not we also ask how? How can you reduce the risk of pilot error accidents? Possibly through better recruitment methods. Most of us here in attendance today have attended a number of seminars throughout the years addressing all of the well known areas affecting safety, such as pilot fatigue, cockpit resource management and the like, all very, very, good subjects. But few, if any, to my knowledge, have addressed the initial pilot selection process as a primary facet of long term accident investigation. I maintain that there is a common thread that can be found if enough data is gathered. Obviously, the super-pilot concept is no guarantee of air safety, I am not advocating that, but I think that most would agree

that it has some merit. When considering the questions of pilot fatigue or bad training methods or design deficiencies, should we not also consider the question of why so many pilots, most pilots, are able to operate under fatiguing conditions and design deficient airplanes for their entire careers without serious incidents?

I think we have to ask the question what is it about them that allows them to operate in a less than ideal situation successfully for so many years? You know, this old term "the right stuff" has become a very commercial term, but I think that possibly when looking for the answers to long term air safety that should be a prime consideration when we consider all the accident investigation data available to us.

The development of better testing methods based on data from accident investigations could make a significant contribution to future accident prevention, and I invite our government agencies and the scientific communities consider making their respective contributions in this area. Contributions of information, not additional regulations and procedures. That is not what we need. Give us some good information and I promise we will put it to good use. Thank you.

Captain Douglas Twynam
Delta Airlines

I am proud to be here this afternoon and have an opportunity to speak to this group.

I began my accident investigation career in 1967 in the crash of a DC-8 training flight in New Orleans. Since that time I have served as a member on the accident teams of ALPA, Delta Airlines, and various other carriers.

I have chosen my area of expertise in cockpit voice recorder and flight data recorder. While I have not limited all my activities to that area, I have, for the most part, marshalled my efforts in that investigatory endeavor. My experience base has been broadened by participation in onsite field investigations, NTSB laboratory activities, public hearings, petitions of record, reconsideration of NTSB reports, as well as the litigation process.

As a party I have often had to operate under what I consider extreme conditions, particularly now from the standpoint of having served on both sides of the street and still serve on one. Even as a management pilot I stand between the pilots and management. I am responsible to management for conducting an investigation which may at some point in time include some of these very people I represent.

Great strides have taken place in the last few years in the technological areas of investigation. The Bureau of Technology, in its use and computation of data from the FDR, cockpit voice recorders, have given a much more realistic margin. But that is not the whole answer. With the great strides in technology and new aircraft, and the final leap into the jet age, the goal of the NTSB inhouse personnel of an all encompassing knowledge of each aircraft and supporting technology has been left behind.

The accident investigator-in-charge, as well as group chairman, now finds himself in the position of resource manager, the resources being the people assigned to his group and the parties to the investigation. He must rely on their expertise to establish a sound analysis on which to prepare a report in support of probable cause.

I cannot stress enough the absolute necessary for thorough onsite investigation, no matter how simple the probable cause might be. Time and time again the Board has let bits and pieces of the puzzle slip through the cracks only to raise doubts days, weeks, or even months later. I would say this to the parties. If you are unhappy with the investigation take a good look in the mirror before you begin throwing rocks at the NTSB. Onsite investigation is incomplete, we are as much to blame as the NTSB is. Leave no stone unturned.

Now I want to talk about field investigations, and particularly the early, early stages of those investigations. Let me say here a few words about the Board's propensity for media coverage. The rules of the NTSB are very specific about who releases what to the media. The rules should be strictly enforced on the parties, and are, I feel the Board should abide by those same rules. Off the cuff remarks that are released inappropriately and out of context applies an undue pressure on the accident investigator in charge as well as the members of the various groups. The media, by virture of these sorts of comments conducts their own investigation, and comes up with conclusions as to probable cause before the field investigation is over. The results are widening the gap between industry as a whole, and particularly the parties involved in the investigation, by prematurely the

released information that is out of context. The public draws its own conclusion of probable cause as presented by the media. The Board's painstaking process is negated in a large way as a result.

A particularly visible deficiency over the last 5 years or so has been the quality of the technical panel when it comes to asking questions of witnesses. The technical panel members are just that. They're not lawyers. The questioning of witnesses is frequently repetitive, irrelevant and unnecessary. Technical panel members make themselves appear untrained, unqualified, insensitive and analytical in an orderly interrogation of witnesses.

Another area which is not at the present time of major concern, but there is still substantial pressure on the NTSB to designate official parties to the accident investigation. Parties unqualified should not be designated.

With regard to the NTSB and its procedures in general it has been Delta's position that the NTSB should concentrate on their primary responsibilities rather than dilute their efforts by numerous special projects. A vigorous attempt to improve and strengthen the quality of investigatory staff is warranted. The Board's lack of qualified staff with practical experience in the aviation industry as it is today is apparent in both the quality of the accident findings and its multitude of recommendations to FAA.

I do not think we should wish to encourage either statutory or regulatory enlargement of the NTSB's role in the industry, or in other Federal agency systems. Nevertheless, one improvement to the present procedure which we would encourage would be to permit the parties to investigation to hear the staff's final recommendation to the Board of any probable cause finding in ample time for the parties to make comments prior to the Board's consideration and/or the adoption of the probable cause finding. This procedure would have permitted Delta to point out the errors that were imbedded in the Delta/Flying Tiger case in the staff recommendation which the Board adopted without the knowledge of the errors in several areas. This procedure we feel would enhance the Board's credibility by assisting it to avoid unnecessary errors in its conclusion.

With all due respect I must say the Board under Chairman Burnett has shown a real interest in making changes as well as a genuine willingness to change what needs to be changed, and I offer my support in this endeavor.

Let me say this. Whatever organization there is in the world, none that I know of offers itself as much for criticism as the NTSB does, and I applaud that. Thank you.

Steve R. Lund
McDonnell Douglas Corporation

First, I would like to say that I am pleased to be here today and to be a part of these discussions with this learned group of aircraft accident investigators. Secondly, I would like to thank the NTSB for giving the McDonnell Douglas Corporation the opportunity to offer suggestions/recommendations and constructive criticism.

Over the past several years that I have personally worked with the members of the Safety Board's staff, they have demonstrated the utmost integrity and professionalism. However, there is one general area we feel needs improvement, namely: communications. This specifically includes communication with operators of equipment similar to that involved in the accident under investigation, communication with the media, communication with foreign governments, and communications with manufacturers.

When, in the course of a jet transport accident investigation, it is learned that remedial action is necessary, the Safety Board's procedures for promulgating safety information are well defined and fully effective, as are those of the McDonnell Douglas Corporation. As a matter of standard procedure, Douglas notifies all operators of an accident immediately, including any precautionary measures that should be taken. For example, after the DC-10 accident in Chicago, intensive investigation and analysis lasting over a year disclosed that, in the final analysis, the first preventative action taken by Douglas in the form of a telex to all DC-10 Operators was the only remedial action necessary, and had been sent to all operators within 24 hours of the accident.

On the other hand, operators of like equipment are generally not advised when it is determined that they need not take any corrective action on their aircraft when an investigation has ruled out any aircraft involvement. The "no news is good news" cliche' just does not apply, especially when the news media coverage of the accident is less than accurate about the technical aspects of the investigation, which is frequently the case. This leaves the airline operator with no official word that no action need be taken on the part of the airline. We therefore recommend that in addition to the closed NTSB/ATA meetings on accident investigation status, the Safety Board adopt the policy of publicly announcing the fact that based on the information gathered thus far, certain aspects of the investigation have been ruled out, i.e. structural failure, engine failure, and/or flightcrew error. We feel this is mandatory when the news media has incorrectly reported the known facts.

This brings us to our second problem in communications: how to accurately relate technical information to the news media. The solution to this problem is simple. Only allow personnel who are technically oriented with the facts to address the members of the media. When a nontechnical person or one who really does not know what's going on in the investigation is allowed to be quoted in the media you often get a perfectly accurate statement, but one that is meaningless to the public and may even be harmful to the Safety Board's image or the public's opinion about a certain type aircraft. For example, just last month, during the on-scene investigation of a fatal landing accident involving a business jet, an investigator from the NTSB, who was in reality nontechnically oriented, was quoted by UPI as follows: "There's nothing yet to help us narrow down the focus. We don't know, to our satisfaction, that the aircraft touched down without it already being in trouble."

Now these statements were in all likelihood sincerely submitted, may have been taken out of context, or may have been misquoted. I do not know for sure. Regardless

of the circumstances, negative statements like these are counterproductive, leaving the public with the feeling that the NTSB knows little except that there may be something wrong with the airplane but have no facts to support their statement. The point is that the media wording is what the public and airlines see, and we strongly recommend that the Safety Board carefully control who is forming public opinion about transportation safety in general and the NTSB in particular. I submit that there are excellent consultants available to effectively train technical individuals who interface with the media and I suggest that the Board consider training technically oriented individuals to more effectively meet the public's demand for the facts.

Next, communications with foreign governments. We feel that a more efficient line of communications should be established with the NTSB's counterparts in foreign governments, especially the third world nations into which a large volume of U.S. jet transports operate.

Some of the problems in communications mentioned above, such as the dissemination of accurate technical information to the media are even more predominant when the accident occurs in a foreign country. In addition, the timeliness of the official reports from foreign agencies leaves much to be desired. We suggest that the Safety Board adopt the policy of releasing factual "preliminary data" prior to the release of official accident reports. In addition, inviting the NTSB's counterparts from foreign countries to attend training seminars conducted by the Board's staff to acquaint them with the U.S. accident investigation practices and procedures would have a dual effect of education plus familiarization with all the individuals involved from each country.

Finally, communication with the manufactures is also very important. This industry symposium is a good start, but these meetings should be held more frequently. We suggest that in addition to providing on-scene technical support, the manufactures can provide other services to the Board. For example, in the area of Safety Recommendations, the Board need only coordinate with the manufactures on the scope and content of recommendations affecting their products prior to their adoption to glean additional technical perspectives. I believe this manufacturer coordination is stipulated in NTSB Order 6400.1A, but to my knowledge it is not thoroughly practiced. We feel that is should be given more emphasis.

We also believe that an NTSB/Industry advisory committee pursuant to the Federal Advisory Committee Act* would be of benefit in maintaining the Board's staff at a level of technology comparable to the industry. As in the past, McDonnell Douglas Corporation will continue to offer the same training as offered to our customers, on a noninterference basis, in the area of aircraft performance and flight and ground crew training.

To summarize, as soon as accident investigation facts warrant, the NTSB should eliminate aircraft malfunctions, pilot error, etc., as areas under investigation. This early dissemination permits the manufacturer to alert other operations with some official word, which avoids needless speculative publicity and helps allay fears of the traveling public.

As we do at McDonnell Douglas Corporation, it is very important to select only trained designated representatives to communicate with the media. Other channels of communication should be redirected, if possible, with responses coming only from individuals briefed on the facts and expressing the public policy of the NTSB. This policy would avoid the consequences of statements "shooting from the hip" and present more accurate information to the public.

*/ Public Law 92-463; 86 Stat. 770.

There should be better communication between NTSB and non-U.S. counterparts. Future efforts might lead to pooling of accident investigation techniques, use of standardized data bases, etc. Information sharing among nations should be stressed, including the timeliness of official reports.

The NTSB could and should communicate with manufacturers on safety recommendations prior to adoption.

Finally, if accident investigation evidence is unclear, it would be far better for the NTSB to release no information than its fragmentary findings. On the other hand, when facts are clear, the NTSB should not hesitate in clearing information through the required channels and getting it to the appropriate agencies.

We believe that if the Safety Board could more effectively communicate the facts of an investigation to the airlines, the media, foreign governments, and maintain a continual dialogue with aircraft manufacturers, that this would enhance the excellent job now being done to maintain air transportation as virtually the safest form of mass transportation. Thank you.

Robert L. Hale
Federal Aviation Administration

I have been asked to speak briefly on the subject of the National Transportation Safety Board's investigations that affect or involve air traffic control or air traffic control personnel. Without intending to be unnecessarily critical or unrealistic, I would say that the system needs specific improvements. I would like to touch on four specific areas.

One, the qualifications of the NTSB group chairmen; two, the composition of typical air traffic control group; three, the request for documents and tapes and; four, controller interviews.

With regard to the qualifications of the NTSB group chairman, I guess that in all fairness we should recognize that air traffic control has changed dramatically in the last 20 years, and particularly in the last 10. Those of us in the Federal Aviation Administration have doubts that air traffic control personnel who are not directly in the facilities themselves can keeping up with the ongoing changes in air traffic control procedures, equipment and techniques without great difficulty. It is perhaps too much to expect the NTSB personnel to keep up with these changes.

But the plain and simple fact is that the Board's air traffic control experience is woefully lacking. At best, it is somewhere around 5 years old, and in many cases over 10. What does all this add up to? Simply, the air traffic control group chairmen and groups are clearly not current on specific subject matter of their investigation.

How can we expect a quality product when the Board's air traffic control experience is 10 or more years removed from real expertise in the subject matter of the inquiry?One final point, and again, one which makes a group chairman's job difficult, and which necessarily affects the quality of the end product. In air traffic control there are substantial differences between terminal functions, the en route functions and flight service station functions. Some accidents involve a terminal background, a flight service station background or an en route background, or in some cases, such as the Air Wisconsin accident, all three. However, the Board seems not to differentiate between the options. As a result, sometimes the group chairman is not only short on real time expertise, but does not have a background in the option being investigated.

Turning now to the air traffic control groups themselves, we find the same problems that I first touched on, plus a few more. Simply, it seems, the Board exercises no direction or control on the kinds of people who are appointed to the air traffic control investigation group. What is their background? What are his or her qualifications? Persons assigned to the ATC phase of the investigation must have the basic qualifications, because they have a real impact on the final group report, and maybe even the findings.

Why do we continue with such an imperfect system? The same logic applies to other groups in the investigation. Parties must appoint qualified persons to get honest, thorough, factual results. I know that I am here to discuss air traffic investigation problems, but if the shoe fits in other places, then it should be worn.

Also on the subject of air traffic control groups I must point out that, at least in my experience, the groups, in particular the group chairmen, seem to follow no established or

uniform practices or procedures. In some cases the controller interviews are hurried and seem to be calculated more for the purpose of getting them done than anything else. In other cases, they seem to end up as a free for all of questions with no focus. Similarly, the demands for documents, records, and particularly air traffic control transcripts is a hit and miss proposition at best. Perhaps I should explain or expand on both these subjects.

In the area of obtaining air traffic control documentations, it seems the Board is preoccupied with having the air traffic control tapes and transcripts sooner rather than later. The FAA will make either or both available, but often it is impossible to supply tapes or transcripts within hours of the accident. You may think it is a 10-minute job to re-record a tape, but believe me, it is not that simple. The FAA has nothing to hide, at least we in Air Traffic Service do not, and we do not believe that if we manage to stall you folks off for a day or so the words on the tape will somehow magically have changed. Certainly, a much bigger problem for me or the agency is the demands upon us for transcripts of the tapes.

Ladies and gentlemen, transcripts are difficult to produce. It takes approximately 4 to 5 hours for just 1 hour of tape. They are especially difficult to produce when someone is breathing down your neck like a kid asking if we are there yet, or how much longer until we get there.

Frequently there are requests made for draft transcripts, as it is understood that they do not take as long to prepare, but there is a great danger in that position. Misinformation is hard to correct, and let's face it, a draft, and certainly a rough draft, will have a lot of misinformation. None of us benefit from a premature release of information, and we believe it.

And we benefit even less when the premature release turns out to be incorrect or misleading information. To prepare a transcript of any significant amount of air traffic control tape is difficult and a time consuming job. To make an accurate transcript, one that we can rely upon and make judgments based upon, is an even more demanding and time consuming task.

In addition to the fact that preparing an accurate transcript takes time, is the fact that our facility staffing is such that we cannot drop everything just to prepare a transcript or record a channel. Please do not forget that while you and me, in most cases, are at a given facility to investigate an accident that facility must still provide an air traffic service to the aviation community just like any other day of the year. I think the Board and the various group members frequently lose sight of that fact. We get so caught up in what we are doing that we forget the facility has a job to do, and they have a very limited resource to do it with. Certainly, all of us who are government employees can appreciate that situation. For those of you who are not government employees, let me say that the cost of less government, a less expensive government, is less service, and we simply do not have the manpower to prepare tapes and a transcript as we used to, and I do not foresee that the good old days will ever return.

In addition to tapes and transcripts the investigation groups almost always want a host of other records. Again, it is not that we do not want to cooperate, we will give the NTSB just about anything they ask for. But there are problems. One has to do with the same staffing limitations I just talked about. The other has to do with the fact that different members of the ATC group will ask different facility personnel for the same

records. Sometimes we even find members of other groups; operations, for example, asking for documents the ATC group already has, and we end up running into ourselves.

If a group chairman will insist on himself being the only source of request, and if he will always make his request of the same person, we will have less difficulty. We are simply forced to adopt a policy that requests made by anyone other than the group chairman, or directed to anyone other than the designated person simply will not be honored.

Finally, let me talk about the air traffic controller interviews. On balance, we all recognize the importance of the interviews, and we have very little problem with the interviews themselves. However, problems arise in the ever present rush to conduct them. This is much like the rush to get copies of the tapes or draft transcripts.

Are we really justifiably in that much of a hurry? It is quite difficult to explain to facility personnel why it is so important and to conduct controller interviews within hours of the accident when the flightcrews, when they are surviving, are frequently not interviewed for as much as a week following the accident. Similarly, while perhaps a little bit off the subject, nevertheless I cannot pass up the opportunity to point out another glaring inconsistency between that accorded flightcrews and that given to controllers. That is, it is routine that all controller interviews are conducted in the presence of all air traffic control group members, that all group members get an opportunity to ask questions. However, when flightcrews are interviewed Federal Aviation Administration team members are often excluded. Even when the FAA is not excluded, we are not usually allowed to ask questions directly to the crewmembers.

What I suggest here is, what is sauce for the goose is sauce for the gander. I realize that the moving force behind the guarded treatment afforded flight crewmembers are their unions rather than employees, but the result if the same. There simply cannot be any justification for this disparate treatment, and whatever else we accomplish in these meetings, I hope we can agree that air traffic controllers are entitled to the same treatment, the same consideration and the same protection as our flightcrew personnel; no better, no worse.

Certainly, controllers are going to demand it, and I suggest it is far better to address that matter now rather than in a fishbowl atmosphere of a major aircraft disaster. Thank you.

John T. Moering
General Electric

Thank you Steve. Good afternoon ladies and gentlemen, my fellow air accident investigators, Chairman Burnett and distinguished members of the Board.

First, I wish to thank the National Transportation Safety Board, for inviting me to participate here today, and to present the comments of one propulsion manufacturer concerning our view of major air accident investigations. Although our turbine engines are also widely used in marine propulsion, pipeline and platform applications, our major accident participation with the NTSB Go-Teams has been mostly in aircraft accidents and incidents.

The full-time accident investigation staff at General Electric consists of four engineers and our secretary. However, we are part of the Chief Engineer's Office and as such command immediate participation from specialists in all disciplines as required. Upon notification of an accident we quickly form a Task Group, with people of all the required skills, and they remain assigned to the working team on the case until completion.

The letter invitation to this symposium solicited constructive criticism from attendees. As a candid appraisal of our experience participating in NTSB investigations, our impressions range from absolutely great to the lower end of the goodness spectrum.

Last year one of our engines had a turbine failure during takeoff roll of a widebody transport operated by a foreign carrier in a mideast country. It was very important for us to obtain access to the primary fracture for metallurgical analysis and, as it turned out, to quickly respond with a corrective action program in the fleet. Due to the inter-government relationships and other complexities involved, the hardware was impounded on foreign soil, and a substantial delay appeared imminent before any conclusive metallurgical results would be available. Near the end of an accident team meeting with several foreign agencies on the issue, the situation was stalemated and nothing was happening. Then our NTSB accredited representative from the NTSB made an effective speech in which he described aviation history wherein repeat accidents had occurred due to the same cause during government investigatory delays. He emphasized the importance of immediate release of the hardware for laboratory analysis in the U.S. As a measure of his credibility, the hardware was en route to JFK the next morning. Our speedy access to this hardware permitted quick isolation of the problem origin and immediate protective action in the fleet. The subsequent support by the foreign authorities and the airline was excellent.

Another good performance by the NTSB was in 1981 involving a widebody propulsion incident in Hong Kong, necessitating extensive ongoing work at the scene during the following month. Through arrangements of the NTSB, the support, cooperation, and services rendered to us by the Hong Kong CAD were outstanding in every respect.

In other countries, for example Japan and France, their governments and industries work closely in supporting each other. I think that the examples I described show the positive aspect of combining the resources of the NTSB and the U.S. manufacturers in obtaining the facts and cause when working on a foreign accident location.

As would be expected in the complexities of international work in air accident investigation, we have also had adverse experiences during these relationships. One example of the frustrations occurred last year during investigation at the site of a major widebody trijet accident in Europe. During the afternoon I had examined the tail engine and found it to be undamaged except for smoke blackening and possible overheat from exposure to the fuselage fire. In fact, the large fan was gently windmilling in the late summer breeze. That same evening I listened to a major newswire report that "According to a high-level, knowledgeable Washington source, destruction of the aircraft by fire was caused by an explosion in the fan section of the tail engine." During the following days the U.S. newspapers as well as the foreign press picked up on this speculative release and published a torrent of false and irresponsible information about this (imaginary) "engine failure" as well as their usual postaccident diatribe. As a result, a major far-eastern airline self-grounded their fleet while waiting for some reassurance on the investigation resulsts. A major U.S. airline balked their acquisition of more of these airplanes with this engine because of the adverse press reports. There was absolutely no engine involvement in the accident cause. Yet, the reverberations from this speculative and irresponsible press release resounded through the world press and even came back and caused us problems in our relationship with the foreign authorities at the accident location.

From our experience the following constructive comments for improvements are offered:

1) Public Information Release - The NTSB Public Relations Officer should exercise a high degree of self discipline and avoid release of conclusive cause statements to the press or TV during the early phases of an air accident investigation. Avoid premature statements of opinion or prejuding relating to accident cause. While the situation in a foreign accident may be extremely difficult, the NTSB should make every effort to effect timely release of factual observations and to minimize uninformed speculation.

2) Site documentation - We need to do a better job of identification of wreckage pieces and documentation of location on the crash site, whether on the runway, the overrun or elsewhere.

   In addition, people documenting wreckage frequently do not know what a part lying on the ground is - in such event it should be tagged and well-photographed for later identity. A more complete and accurate job of identify and location record is needed. The wreckage team should always include representatives of engine and airplane manufacturers who are personally familiar with the hardware and can reorganize fragments on sight.

3) Foreign Accident Investigations - I realize this is a difficult challenge but we need to keep trying to influence an upgrade of the job done at foreign sites where the prime conduct of the investigation is under command of foreign authorities. From our observations, NTSB representatives on occasion are reluctant to apply the considerable influence they do have. Where a professional job is not being done, and the information is important to the U.S. interest, they should try to influence the local authorities to accurately map the wreckage site, recording the location and identity of each piece.

   It is very important for the team members to obtain access to the DFDR data as soon as possible during the on-site phase of the investigation. When

available, the data should be accessible to all the members of the U.S. technical team, not just to favored individuals.

Prompt release of factual information is important to avoid recurrence, to guide the actions of other operators of similar equipment and to the manufacturers in swiftly implementing action recommendations to the fleet.

4) Technical Review - We thoroughly endorse the policy stated this morning, that the NTSB have a conference for technical review by all parties after the data gathering phase has been completed. In our experience this must be a new policy and we look forward to its application in the accident we are presently working on together. This would help ensure that all pertinent data has been accumulated for analysis and that everyone is working with the same facts.

5) Foreign Incidents - On occasion we will travel alone outside of the U.S. to investigate a fairly serious incident which has not been officially recognized by the NTSB as an accident. We will be investigating in a foreign country without the friendly umbrella of an accompanying U.S. NTSB accredited representative. This sometimes presents problems. What is needed is some form of surrogate recognition as U.S. NTSB endorsed representative with some form of accreditation by means of a State Department wire. If this could be worked out quickly as evidence of coordination with the NTSB for recognition as a technical advisor to the U.S. NTSB, this would be most helpful.

6) Reports - The quality of reports both as to validity of conclusions drawn, use of the available factual evidence, and thoroughness of analysis ranges from very good to curious instances suggesting preconclusion. We are pleased to note a recent trend of improvement in report quality. One of the most disappointing things to see in a report is the selective application of factual data. We believe that all of the significant factual data should be recognized, and where there are conflicts with the hypothesis posed in reconstruction of the failure sequence, they should be so stated, even if listed as "bothersome leftover facts which presently don't fit into the conclusions."

A format which is compulsory in our own reports on major engine failure investigations includes a section titled "Reconstruction of Failure-Sequence of Events." This format requires a column of "Sequential step description," and opposite each step of the hypothesis, a description of "Supporting Evidence" and "Conflicting Evidence." We require the visible presentation, for critical examination on the record, of all the factual evidence and the rationale for the subsequent conclusions drawn. In some of the NTSB reports, one sometimes wishes for visibility into the reasons for not recognizing all of the factual evidence.

Regarding report results, the parties should be informed of the planned recommendations prior to issuance of the report. The parties should have an opportunity to comment before the recommendations are adopted.

Thank you.

ISSUE: GENERAL AVIATION ACCIDENT INVESTIGATION - "A Critique"

Panel 1:

Moderator - Vernon A. Taylor, Bureau of Field Operations

John S. Yodice	Aircraft Owners and Pilots Association
Chester A. Rembleske	Beech Aircraft Company
Harold Mesaris	Avco Lycoming
Kenneth Kress	Federal Aviation Administration
Paul Byrne	Sperry Flight Systems

Panel 2:

Moderator - Alan L. Crawford, Bureau of Field Operations

Frank Schick	Gates Learjet Corporation
Paul R. Powers	Bell Helicopter Textron
Frank Harris	Cessna Aircraft Company
Captain James A. McIntyre	Air Line Pilots Association

John S. Yodice
Aircraft Owners and Pilots Association

I would like to thank the National Transportation Safety Board and its staff for the opportunity for me and my associates at AOPA to participate in this critique of NTSB general aviation accident investigations. I know that the Board is frequently criticized for having as its major purpose to find fault, to criticize, and to make recommendations regardless of the practicality of consequences.

Well, the fact that the Board is willing to invite criticism on itself, not once but twice, counting Downingtown, in this kind of an industry symposium demonstrates a sensitivity to its own role as a critic which we think is healthy. For that reason we applaud the Board.

Also preliminary, I want to say that I approach this task with some humility. Just being on this panel would seem to suggest that I know how the Board should do its job better. I am not sure that I do, but I do know that I come to this symposium with a perspective; a perspective of a lawyer who has participated in many, if not all, of the NTSB hearings involving major air disasters which had general aviation involvement, and also, had counseled many pilots and aircraft operators who have been involved in accidents, counseled them regarding accident investigation and the legal consequences which flow from the accident, and also being an active general aviation pilot myself. I think that is a perspective that the Board may not have.

I guess I should also say that in attendance with me are two other associates from AOPA. One is Bob Warner, who is with our policy staff at AOPA, and Russ Lawton, who is with the AOPA Air Safety Foundation. They too interact with the Board in other areas, and we are hoping that our collective experience from the general aviation perspective from outside the Board will help advance the discussions that I know we will have after this session, as well as in the panels that will take place tomorrow.

In the few minutes I have available for my direct remarks I would like to identify some areas which I hope we can fully explore in those other sessions.

One area that has concerned me a good bit is the public perception that we, the NTSB and the industry, seem to have created in accident investigations, and especially in the public hearings on major air disasters. We seem to wash our dirty linen in public with no apparent purpose but to find fault; to point the finger at the other guy. We pick away at what seem to be defects in our system, whether they are really there or not. And it seems to me that aviation comes off sounding more dangerous than it really is, and the people in aviation, pilots, controllers, government regulators, manufacturers, appear less than the high quality people that we know them to be.

Now, there are at least two reasons for that, at least two that I would like to identify; there are probably more. One is that aviation accidents are hot news, and the Board's investigatory activities in ferreting out the facts and circumstances of an accident seem to lend themselves to press coverage. I think that is especially true of the hearings. It tends to satisfy the natural curiosity of the public to find out what has happened in this very hot, newsworthy item.

I question whether the circus atmosphere that I have observed in numerous instances is conducive to the Board's function of determining probable cause and measures to

prevent future accidents. I question whether the Board has done all it can to assure a more conducive atmosphere.

There is another reason for the distorted picture the public gets from the press coverage that is the specter of tort liability. Theoretically, concerns for tort liability have no place in the NTSB investigation of an accident, but anyone who has had any experience with NTSB investigations knows that this concern permeates most investigations, and in some instances, overshadows the NTSB purpose.

The public, through the press, sees all the angling and wrangling among the parties and aviation does not come off looking very good. I question whether the Board has done all it can to keep liability considerations out. I question whether the Board has done all it can to keep its work product out of the litigation arena. I think it is the root of the problem.

Another area which I believe merits scrutiny is the Board's indifference to the plight of a pilot involved in an accident being investigated by the FAA on delegation by the Board. My experience is that virtually all pilots understand the purpose of the investigation, and want to cooperate in the investigation of an accident in which they are involved. But the Board, in many instances, sends out an FAA inspector to investigate for it, and that inspector is also charged by the FAA with investigating for and prosecuting regulatory violations. For those who do not know it, NTSB delegates to FAA the investigation of most nonfatal general aviation accidents. If the FAA inspector is faithful to both his roles, as he must be, the situation is not conducive to full disclosure of the facts so necessary to the Board's work. Furthermore, it creates an unfair dilemma for a conscientious pilot.

On another matter - and we heard a lot about this yesterday - we would like to urge the NTSB to provide the participation by industry representatives at the analysis and recommendation phases of an accident investigation. We are now permitted to participate in the accident investigation if we have the appropriate expertise to offer the Board. But after the field phase of the investigation terminates or the hearing closes the Board goes behind closed doors. We often have been disappointed at what comes out of an investigation in which we have participated.

I suggest that the aviation industry representatives have a lot to offer to the Board, not only in the investigatory phases, field investigation and hearing, but also at the analysis and recommendations stage.

Lastly, we are disappointed at the Board's recent decision to become involved in ultralight accident investigations. For those of you who may not know it, last month the NTSB announced that it will investigate all fatal ultralight accidents, as well as other selected ultralight accidents. We suggest that this is not the best use of NTSB resources. For one thing, this activity is a sport or recreation, and not transportation. Ultralights are by definition one place vehicles and have very limited range and performance. As we read the law, NTSB is charged with the responsibility for investigating transportation accidents. NTSB does not investigate snowmobile accidents, it does not investigate dirt bike accidents, or even water skiing accidents. Why ultralights?

Yesterday we heard the Director of the Bureau of Field Operations say that NTSB is investigating in order to protect the public. Well, we sense no great outcry by the public for Board participation in this kind of activity. Furthermore, from our experience, there

is no significant risk to the public, except maybe those who voluntarily participate in the sport.

Rather, we support the FAA approach to regulate to the minimum extent and to allow maximum opportunity for self-regulation. AOPA has organized an Ultralight Division that has already over 7,000 members and is growing every day. The AOPA Air Safety Foundation has initiated a pilot registration program and an ultralight vehicle registration program, and most importantly, and accident reporting program. These programs have been approved by the FAA. So the safety of the activity through self-regulation, we believe, is well underway. We are concerned that the heavy hand of the Board may damage these programs. We are also concerned that the Board's efforts are a waste of its limited resources, and that the Board is intruding itself into a nontransportation activity. We suggest that the Board reconsider its position on this matter.

That's about all time time I have to mention the items which I have already suggested I think we further explore hopefully in the discussion today and the work sessions tomorrow. Thank you.

Chester A. Rembleske
Beech Aircraft Company

Good morning. For a start, I wish to add my thanks to those expressed yesterday, and also my contratulations to the Board for convening this seminar. I might add that I hope that 8 years will not pass before be have another such session. After all, we are a part of a very dynamic and fast moving technology area, and we need to get together more often than once every 8 years.

As a result of many years of experience accumulated by the various manufacturers in investigation of aircraft accidents, it has been concluded by most of us that improvements in the investigation process can be made. Some of the discussions, some of the suggestions have been talked about in the past. Some are a result of experiences which have taken place since a meeting like this last occurred.

Suggestions being made this morning have been discussed with other U.S. aircraft manufacturers, and as a matter of fact, some of the discussion I will bring you this morning are as a result of their input. Recently, we have heard that consideration is being given to further delegation of accident investigation responsibility to the FAA. While I realize that nothing formal has been established to date, at least to my knowledge, I believe that any move in this direction will be detrimental to the accident investigation process. Rather than broaden that delegation over that which exists today, I suggest that the NTSB retrench and concentrate all their investigative functions within their own organization. Why? First of all, many of our experiences with non-NTSB accident investigators indicate that many of them do not relish the assignment, and therefore, the end result leaves much to be desired. If FAA inspectors are to be placed in charge of field investigations, they should be well trained accident investigators. It has been our experience that when an operations inspector is placed in charge of an investigation he will devote most of his time to the man or environment elements of the accident investigation triangle and ignore the machine element.

Likewise, if a maintenance inspector is sent to investigate the accident he pays most of his attention to the machine and forgets about the man and the environment. All elements of this triangle must be investigated in order to arrive at a meaningful probable cause, and in order for the investigation to be useful in accident prevention.

A poor accident investigation - and you have heard this many times - is worse than no investigation at all. Poor investigations often overlook pertinent information which may lead to conclusions which are absolutely incorrect. Formal training in techniques associated with accident investigation is absolutely necessary.

With today's available technology which can be put to use in accident investigation, only training will expose the investigator to the technical tools available to him to accomplish his objective. Only training under qualified instructors will provide the information to the investigator on how to use many of these technological tools available today.

I suggest that the NTSB consider the reestablishment of a training program for all those charged with the responsibility of accident investigation, and in addition to a formal training program, some type of apprenticeship system needs to be established to permit hands-on experience to be gained by trainees while working with experienced investigators.

I believe that it is advisable that in addition to training new investigators, refresher training courses are justified, in view of the rapid movement of our technology in the design field. I am sure that various manufacturers would be pleased to provide documents such as manuals, drawings, technical instruction if desired, to familiarize students with the various general aviation aircraft in their more complex systems.

The NTSB needs to pursue the inclusions of standardized autopsy and pathology information in their report. This standard should include, if at all possible, x-rays of the pilot and copilot. I think we talked about this at the last meeting we had. I do not know that much has been done in this area; I have seen no evidence of it. Experience has shown that such information is very valuable when evaluating the data collected in an accident, and in some cases, assist in establishing causal factors with more credibility.

To get the factual information useful to the accident investigator, I would suggest that a program be established to publish a set of instructions formulated under the auspices of the NTSB which would delineate the information desired. This information would then be available to those charged with conducting autopsies to ensure that the data required would be obtained and documented. I am sure there are qualified people in the industry and in medical circles who would be pleased to volunteer their services in the formulation of such data requirements, and possibly participate in the establishment of a format for this information so that it would be presented in a uniform and consistent manner.

An area which needs more attention in the accident investigation process is the exploration of the pilot's and/or copilot's psychological and personal profile. A good investigation into their background, both personal and professional, can lead to avenues of investigation which are not being pursued today in a timely manner. Background data, which in some cases is found long after an accident report is filed, is often relevant, or could have been relevant to the establishment of the causal factors of a specific accident.

Another area I feel needs more attention in the accident investigation scheme of things is the need for investigator personnel to pursue, without fail, the collection of air traffic control information available on any incident or accident being investigated. A prompt collection and evaluation of this information early in the investigation scenario may save much time in what might be an otherwise fruitless and far flung investigation. Experience has shown that in many cases this type of information can quickly lead to the narrowing of the necessary fields of investigation. An adequate investigator training program could provide the background training necessary to collect and evaluate this data in the field.

Photographic coverage is an area that needs attention. All too often photographic coverage by the investigators in the field is poor and incomplete. Adequate photos to back up the narrative of a report should be a must. Many times statements are made in final reports with no photographs or physical evidence to back them up. This occurs many times after the wreckage has been destroyed. We have all heard that a picture is worth a 1,000 words, but very often we do not have that picture.

Quality of photos in some cases leaves a lot to be desired. Again, a good training program should include training the investigators in this area of expertise. While speaking of wreckage, one other area that ought to be considered, all too often wreckage is released much too early. It is hauled off to the junkyard or to the used parts dealer where it is utilized in such a way that it becomes useless towards further investigation of the

accident. I think the Board and the investigators need to consider, and to make sure that there will be no further use of that material before it is released.

Several years ago the NTSB came up with a statistic which stated that 61 percent of the civil aircraft accidents in the U.S. occurred during the landing of takeoff regime. I believe they stated in that report that 40 percent occurred during approach and landing, and 20 percent during the takeoff.

We need statistics in our industry that relate accidents to flight operations instead of hours flown. One flight operation includes one takeoff to flight and then one landing. It is well known that during 300 to 400 hours of flying the average general aviation airplane, or those operated by the commuter industry, will be involved in significantly more flight operations than airplanes that are flown by trunk or regional airlines.

That being the case, accident statistics, in order to be more meaningful, should be related to flight operations instead of hours flown. Now, we may want to keep both yardsticks, but I think we should consider the establishment of a second yardstick which will truly portray the safety of general aviation.

Now an area where the NTSB and the FAA both become involved; the pursuit and prosecution of owners, pilots, operators and maintenance personnel for the improper operation of aircraft, improper maintenance, out of CG, overweight, nonqualified operators, VFR pilots operating under IFR conditions, pilots operating the aircraft outside of the area covered by their rating should be prosecuted and be responsibly penalized for their actions.

Responsible counterparts in our industry, I am sure, would back such action by the FAA. It is tragic to read some of the clearcut violations of regulations that often result in an accident, something where little or no enforcement action of note is taken, or where action taken for previous transgression was so minimal as to have no corrective influence on the pilots or operators.

Witness statements are an important part of accident investigation, and should be considered so. It has been our experience that a witness is often handed a witness statement form and is asked to explain his observations without being questioned by the investigator. The witnesses will describe approximately 50 percent of their observations, according to our previous information.

These observations can be very, very important. In order to obtain all the relevant information that the witness has, he or she must be interviewed by the investigating team, and the statement should be completed in the presence of the team. It is unfortunate, but in too many cases the investigator-in-charge will leave the witness form for the witness to fill out and mail it to his office, or even on some occasions, he will mail a witness form to the witness after he has returned to the office.

I would like to endorse the statements that were made yesterday about the communication between the Board, the investigator and the media. All too often preliminary statements given to the news media are incorrect and permit embarrassing situations to arise among the Board, the investigator and the news media.

Another area that was mentioned yesterday that I would like to just touch on, and that is crashworthiness. We heard that the Board is going to increase crashworthiness investigations in aircraft accidents. I think this is very meaningful data, but a system

needs to be established which puts some meaning into what they are reporting; some basis of determining the crashworthiness, and some basis for determining what type of factors, load factors, might have been experienced during a specific accident. Was the accident survivable or not, rather than just leaving it to the investigators, a good yardstick, as meaningful as is possible, needs to be made available. With today's technology such information can be obtained and would be useful in many accidents.

I would like to reinforce the recommendations made yesterday that the various parties to an accident investigation be permitted to comment on and discuss with the Board, or its delegate, proposed recommendations, and also the final accident report before it is approved by the Board. I feel such activity would prevent some of the embarrassment that has occurred in the past.

All too often we hear that certain investigators are going to make certain recommendations as a result of an accident investigation. We do not make comment at the time, but when we see the final recommendation, it is not at all what we thought it was going to be as a result of our discussion with the accident investigator. Evidently there are too many hands between the accident investigator and the final production of the recommendation, and many times they do not even recognize the results. Again, it would eliminate many, many errors, and we feel would bring good credit to everyone to having better and more realistic recommendations made.

I think in summary I would summarize what I have been saying here. If a good professional training program was undertaken for current and future investigators such a program could be structured to include not only consideration of the idea that I proposed today, but many others made by other people.

Now, obviously, my comments do not apply to all accident investigators and all accidents. But they are based on many of our accident experiences in the field, and if only some of these ideas are considered and adopted by the Board we will have a much better accident investigation process in our country. I thank you very much.

Harold Mesaris
Avco Lycoming

I would like to take a moment to thank the NTSB, and in particular, those of you who helped organize this meeting. It is mine and Avco's hope that this meeting will be beneficial to the aviation community and will lead to an improvement in overall aviation safety.

I have been actively involved in general aviation accident investigation for Avco-Lycoming since 1976. Avco-Lycoming engines are found in a wide range of general aviation aircraft and helicopters. We are actively involved with the investigation of many types of accidents and incidents.

Obviously, the range of our involvement in the investigation of these accidents or incidents varies greatly. The best investigations, in my opinion, are those investigations in which the investigator-in-charge uses all of the minds which are available to him in the evaluation of the accident data.

Many ill-conceived ideas or interpretations of actual facts can materially distort the whole picture of the accident, and can be eliminated by the simple process of analyzing and talking about impressions at the crash site or on subsequent exam. We are talking about communication.

Too often I have been made aware of, or have witnessed, the polarization of various investigators and the different entities who are normally present during an investigation, and there is little or no exchange of ideas, so the whole investigation suffers as a result. To be successful in his evaluation as to probable cause and the prevention of accidents, the investigator-in-charge should use all inputs available to him.

One of the major problems we have encountered in the last year and a half are the changes in investigative procedures between the FAA and the NTSB related to delegated or desk audit category accidents. Many of these accidents, while not producing a significant increments for damage to the airplane, provide information which can lead to changes in maintenance, operations, design, or manufacture which can prevent recurrence.

On numerous occasions, particularly in the summer, when accidents and incidents occur in greater numbers, I have talked with the NTSB investigator-in-charge and have been told that the accident or incident was being handled as a desk audit, and that the FAA would be checking into the matter for him. In my next call to the FAA, I am informed by that individual that no, the FAA is not investigating, that the NTSB is handling this particular accident or incident. In effect, and I have observed this on numerous occasions, neither the FAA nor the NTSB investigates the accident or incident, and all the information that goes into the official report is generated by the pilot, or often by the individual who is doing the maintenance on the aircraft. I seriously question the meaningfulness of data obtained in this manner, and wonder what effect it will have on the accident data base.

We believe an accident which occurs when an aircraft employing one of our engines needs to be investigated completely to the extent that engine involvement as a causal or contributing factor is either established or eliminated. A brief visual check of an engine

onscene is not enough to properly evaluate the power plant. Does it, for instance, contain a broken valve, or evidence of a stuck valve which could have distracted the VFR, on top, noninstrument rated pilot to lead that individual descending into the weather and crashing out of control into the terrain?

There was an accident last year in the southeastern United Stated which vividly points out why accidents must be investigated completely. This accident happened to be a delegated accident. The pilot was not instrument rated, he had his family onboard and had not filed a flight plan and was en route legally on top of the weather to his destination. The aircraft, for reasons initially unknown, got into the weather and crashed with all aboard suriving but seriously injured and initially unable to communicate.

A brief onsite investigation was conducted by the FAA with the general consensus being reached that there was nothing wrong with the aircraft or engine and the wreckage was released to the insurance adjuster with no further investigation planned. The accident was being written off as a typical VFR pilot in IFR conditions accident.

Several days later the pilot became coherent enough to tell his nurses to pass along to the Federal investigators that he had had an oil leak and engine failure which forced him to descend into the overcast and ultimately crash. The engine was then taken back over by the FAA and the investigation reopened. Ensuing engine examination and teardown revealed a broken propellor governor oil line which had been repaired the day before the flight with nonaviation approved parts.

It is quite obvious that had the pilot not survived and been able to relate events leading to the crash this engine would not have been examined under the government supervision, and the real reason for the accident might not have been found. The flying public deserves a complete investigation of all aviation accidents so that the actual cause can be determined, if possible.

It has been our experience that the worst approach that can be taken to an accident is to simply write it off based on weather or other conditions. There is no way to know what may have entered the chain of events leading to a crash unless it is investigated. Budgetary constraints placed upon the NTSB, and in particular, the FAA, leads to some incomplete investigations. We stand ready to support the complete investigation of all accidents involving our product. We believe investigation should be carried to completeness under NTSB or FAA control.

Another problem that we have encountered is that during many desk audits the engine serial number is not obtained. We need to enter into each engine's historical record any involvement in an accident or an incident. This information becomes very important if that engine is involved in another accident or incident due to a failed part. Quite often this failed part is a result of damage occurring in the first accident or incident.

The new NTSB reporting format contains a space for the engine serial number. However, the preliminary report does not require a serial number. It has been my experience that when the serial number is not obtained during the initial stages of the investigation it will not be recorded, and therefore, a potentially important piece of engine history is lost and erroneous conclusions may be drawn at some time in the future.

One aspect of the response to aviation accidents which we feel needs to be brought up in discussion is the mandatory destruction of critical components which are involved in

accidents. We believe there should be a mandatory destruction policy or a federally supervised mandatory destruction group so the critical parts which have not been adequately inspected will not be returned to service only to lead to another accident with perhaps much more tragic results.

A good example of such a component is the crankshaft of a reciprocating engine. This is an expensive component that operators often return to service but which is particularly susceptible to crash damage.

We believe that through the evaluation of accidents and incidents much useful information can be obtained which, when properly utilized, can lead to a safer flying environment for us all. Toward this end we stand ready and willing to cooperate and to assist the NTSB in the investigation of aircraft accidents and incidents involving our product. I want to thank you all.

Kenneth Kress
Federal Aviation Administration

Thank you. I am honored to be participating in this conference, and I have been trying to figure out at times why this is not done more often. I suppose there is a budget problem.

Briefly speaking, when we have an accident or an incident of significant occurrence we contact the Atlanta NTSB office. We discuss what we have on the telephone, and try to classify what we have and hope to get a prompt decision from the NTSB. Normally, we receive a decision shortly thereafter of their intentions of how the Board is going to participate. The Board correlates all information through us and with us, and decides whether they will handle the accident or delegate it to us.

We do not have any problem with the decision, regardless of which way it goes. However, now we are in a freeze, and have been for so long I cannot remember. The reduction in manpower has been difficult. For example, we have in our office lost 50 percent of our maintenance capability to retirements, and we cover everything from air carriers, commuters, even to ultralights, 7 days a week. I am really amazed at times how it all works. But we have to, and we are delegating all types of activities at a faster pace than we were a couple of years ago. There are not new areas; we have just increased delegation. We have to cope with more activities and less manpower.

The main thrust I want to make here today is the further delegation on a selective basis by the FAA. Primarily, I would suggest it be considered to motivate some program for the ultralight vehicles and the delegation in the incident/accident area, for example, to the States' State Aeronautical Commission, or to their police departments, or State Police forces. A lot of the States are well organized now and very active in the aviation area. They have codes or regulations on their books that they must participate and make a report of any accident of certain types within their State boundaries.

At the end of World War II we were probably in worse shape than we are now. We had no manpower as the war was ending. As a collateral duty I was a liaison inspector with the State of Pennsylvania. We assisted the State director and the State Aviation Commission to put together a program with the CAB's concurrence and FAA concurrence to structure a program which would establish an accident investigation division and an enforcement branch in their State Aeronautics Commission manned by State Police.

We structured the program, and the State selected six State troopers that had aviation backgrounds. We moved toward a delegation program, and they investigated all accidents where there was no injury or serious injuries only. The State Aviation Commission did the entire investigation, and we participated in all serious selected accidents and all fatal accidents.

The State also had an enforcement program of investigating flying complaints. We delegated 100 percent of these occurrences. Of course, their action would pertain to the civil penalty area only, and they had a program that they could investigate the complaint, assemble all the witnesses, the facts, and then pick up the pilot and take him down to local justice, and that is what they got, instant justice. It sure beat the 10-month or a year program of our administrative lag to collect the same amount of money from the same pilot, so it worked great.

So we got this instant justice program and we got their attention real quick. We took the file from them and if we wanted to move into the suspension and revocation areas, that's what we did. In their accidents they used a form that did not fit our base at that time too well. However, we were able to do a desk analysis from their investigation, and it worked very well.

I think that we should go back now and take a look at that program on a complete national basis. I do not have a good feel for how many States are well organized. I know that some are, and they are doing a good job whether we tell them or not because that is their responsibility. I also think that we should move into the ultralight program, and the home-built program, since they do not have airworthiness standards. We do have a responsibility to the public in these areas, so we should establish some kind of data base, and some indicators of what to look for in these areas. Thank you very much.

Paul Byrne
Sperry Flight Systems

Good morning. I'm here representing Sperry Avionics, and as you know, we probably make about half of the avionics parts which are in light aircraft, and light jets, and the business jets. We thank the NTSB for asking us to come here.

I think there should have a little more emphasis on three or four items during Safety Board accident investigations and prior to the investigations. These items are training, coordination, communications. We think that the Safety Board should be developing some market experience and doing a little planning for the future of general aviation equipment.

We, as a member of the general aviation community have a continuing interest in contributing to a good safety record of the aircraft which have our equipment on board. Aside from our normal ideas, we maintain this interest to retain our place in the market. Our interest is also tweaked a little by the FAA, since we must get it certificated, and then maintain our equipment up to the various regulations and circulars.

When this equipment gets to an operator we find sometimes he does not know how the new generation equipment works. As a result, we train for the operation of these systems. We think that the NTSB needs the same kind of training. We offer the training to the operators, and they usually take us up on it. We have the same type of training available for the NTSB, but I do not think the Board has taken advantage of our facilities yet.

Safety Board investigators, like the pilot, cannot fully understand the avionics equipment if they are not informed on its opportunity. We do not feel that they can adequately investigate an accident when they do not know the equipment that the operator is using. The lack of training or knowledge on the system can prolong an investigation, and it can actually guide it to irrelevant areas.

However, in lieu of the training, the manufacturer can provide the Safety Board directly with expertise on the system and components by providing a consultant. The manufacturer's expertise can be used to supplement the Board's knowledge in this way. So if the Board does not take us up on training, we would like to be consulted in the accident investigation or review. We feel that this method or mode of operation can save the Board time and money during an investigation.

We also feel that during a followup investigation the manufacturer's test facility should be available, and ours are available to the NTSB, to supplement their labs. We feel that the Board investigator can gain some insight into the pre- or postcondition of the system or components of the system during an investigation of this type. Again, we feel that this could save the Board time and money.

During the past years we have made our equipment much more sophisticated. Our instrument systems have gone from mechanical to electromechanical to now pure electronics. This is true not only of the instrument systems, but also of the automatic flight control systems. We are expecting even more rapid change in the future upcoming generations of equipment. The digital computer has come to general aviation now.

However, with each of these progressive steps we have reduced the amount of intelligence available to an accident investigator. The most pronounced of these changes in the current generation of aircraft is the EFIS system, Electronic Flight Instrument System. We see the glass cockpit now, and when we get the glass cockpit involved in flying aircraft we are going to lose one of the best intelligence sources for an accident, the instrument positions.

The Safety Board and the industry in general needs to be thinking about how we can supplement this loss, how we can retrieve some of the information that we have now. See, for all the progressive steps we are still taking, the retrogressive steps are in the form of lost accident intelligence. We feel that the more sophisticated system could exhibit performance improvements and be safer, and in most cases they are. But still we have accidents, and the fatalities associated with accidents are increasing.

One of the results of these accidents are tighter regulatory controls. The tighter controls make the avionic systems more expensive, harder to build, harder to certify, and when you get tighter controls you do not necessarily increase the operational capability of the system. One possible means of counteracting this tendency to tighter controls is to achieve a more realistic or more precise definition of the cost of an accident. To get a more precise definition we need to provide the accident investigators with more precise data on what caused the accident and the flight condition of the involved aircraft. With this data we feel that the NTSB recommendations could be more specific, and when their recommendations are more specific we feel that we could be more specific in the response to the recommendations. In this way the regulations could become specific, and perhaps the regulatory spiral could be slowed a bit.

Well, how can we get the increased data we said was going away with the EFIS systems? Well, the general aviation aircraft, as you all know, is not equipped with a flight data recorder. Perhaps we should be making this type of a system available. We have sophistication being built into our newer systems. Maybe the NTSB should be convincing the industry of the need for the flight data recorder function as a portion of a maintenance trend analysis.

I think in general the NTSB should be working harder to support their requirements for data, whether it be a flight data recorder or some type of device. The results of this selling could be beneficial to aviation, general aviation, by finding a more accurate probable cause determination from the investigation. This could reduce the cost of the production of the equipment and the cost per unit performance could be increased.

Finally, when there is an accident, we in general aviation usually hear about it through the grapevine. We are concerned from a legal point of view. We have a lot of friends in the general aviation industry who pass information on to us, but we are never informed via the official channels. If there is an indication that an avionics system or a component of a system has been involved to any degree in an accident, we want to be, and should be, involved in the investigation. Even if there is no indication of cause, we believe that we can answer a lot of questions that the NTSB should have in the accident investigation.

So to sum up, we would like to say that we believe the avionics manufacturers, the FAA, and the Safety Board should be working together now, plan for the future and plan for safety and safer aircraft. Thank you.

Frank Schick
Gates Learjet Corporation

Good morning. I went back to my room last night and read the speech I had prepared for today and decided that most of the points I wanted to raise had already been mentioned. My first point, discussed yesterday, was that this critique is really a critique of all of us involved in an accident investigation, not just a critique of the NTSB.

My second recommendation was for more thorough human factors inquiries in the future, which was also stated as a Board policy.

Several persons made my third point, which concerns the recommendation to allow all parties to participate in the accident analysis.

And finally, many persons discussed at length my last point, which concerned the extraction and use of ATC radar data in the reconstruction of flight paths in airplanes like ours, which generally have no cockpit voice recorders or flight data recorders.

Well, I am last on the agenda, and we are nearly on schedule this morning, so I do not have to sit down now. But all the points I had planned to raise have already been raised, so why should I repeat them? I am standing here speaking to some of the most outstanding people in this aviation industry. People who build airplanes, who operate the aircraft, and who regulate those activities, some of whom have been doing those things for nearly as many years as I am old.

So why should I repeat things that these distinguished, dedicated people have already said? I thought about that last night. Why should I, with barely 5 years of experience in accident investigation, repeat what these people have already said? I convinced myself last night that maybe there is a reason for doing that. Maybe the NTSB is like all the rest of us, and like the management of several organizations at least that I have seen, maybe we have not said the same thing in enough different ways yet for the NTSB to see that light turn on.

A reason for repetition might just be that, like we are all guilty of sometimes, the NTSB is not or has not been really listening. In 1978, near the beginning of my 5 years experience, I attended a meeting in Wichita which most of you big iron people probably missed. It was a GAMA-NTSB meeting, and I do not think it has been mentioned yet this week. It followed a format similar to this meeting with similar criticisms being offered in both directions, as I recall. But I know some of the issues discussed there were discussed here, and I have heard comments here which reinforce my feelings about the probable outcome of this type of meeting.

Now, I do not mean to detract from any of the speakers previous to my little talk here, but I venture to say that the NTSB has not heard very many ideas here in these 2 days that they have not heard before, and probably more than once before.

So this is my reason for repeating what has been said before. From what I have seen in the past 5 years, the way to get the Board to do something must be to repeat, and repeat, and repeat, and repeat. Since I am comparatively near the beginning of my accident investigation career, and many of you who have helped make the strides forward to where we are today are nearing the maturity of your careers, I and others like me, need to pick up the drum and take our turns beating and repeating as often as is necessary to help keep this field progressing as it has in the past. So I will begin my part now and

repeat the recommendations I started with.

Number one, run a more thorough human factors phase;

Number two, allow us all to participate in a meaningful technical review and in the analysis;

Number three, devise a scheme in conjuction with the FAA that allows the best use of all available ATC radar data for flight path reconstruction, and I must add my final recommendation;

Number four, listen.

Thank you very much.

Paul R. Powers
Bell Helicopter Textron

Good morning. The director of safety and certification means that I can shift myself and fit either into the Safety Board or the FAA. You have probably noticed that I am a recent convert to the big, wide, wonderful world of whirlybirds, and I guess, as many other converts, I have a considerable zeal. The difference is that I now recognize it.

I could have sat here all day yesterday and except for what I was doing before with American Airlines I would not have been able to relate very well to the session. I heard unusual terms, such as Go-Teams, international investigations, a whole bunch of things that are fairly strange to us.

I think this session is outstanding. I have enjoyed seeing many of the people that I have not seen for awhile. I think it is important, though, that we should recognize that we do not need a session like this to reach the NTSB. I do not know when I have ever seen a group at such a high level that is so accessible, and this is from the Chairman down. I certainly hope that you all are not going to keep any real burning issues to wait for another meeting such as this to get things going.

In our area, with helicopters, perhaps the greatest problem is a lack of expertise, not recognizing the unique characteristics of this aircraft. Now, most people will say, oh, yes, helicopters are different, but this does not seem to influence the manner in which they are investigated. There are people that know really nothing about a helicopter, in both the NTSB and the FAA, going out and trying to investigate.

I figure that I am about as good as the average there, but there is no way that I would go out and conduct a helicopter investigation because I have only been at this for 2 years with helicopters, and I do not consider myself qualified. But I must hastily say that both the NTSB and the FAA have been outstanding in cooperation in permitting us, the manufacturer, to participate in these investigations.

I would also like to say that I would not expect the NTSB and FAA to try and train people in all the models of general aviation aircraft, all the models of helicopter, to the level that I would expect, and perhaps demand, in the conduct of the investigation. And as long as we are permitted to participate I do not think we could ask a great deal more.

We are aware of the Chairman having approved an orientation course for NTSB people that will be starting next Monday. This is a great step forward. It gets right to the issue that we were talking about. Familiarity. Lack of expertise. This will increase an understanding. Mr. Walt Luffsey, Associate Administrator of FAA, has told me that he expects to do the same thing with people from the GADO's. That would be a great step forward. That will actually fill a tremendous void that now exists. I will just say onward and upward in that area.

There are some instances when a breakdown in coordination or a difference in certification of NTSB policy as it relates to party participation causes a bit of confusion, and not just for ourselves, but for other parties to the investigation. You see, with the helicopters, again the IIC is usually the whole investigating effort, except what he might pick up in the way of party participation. There are times, for very logical reasons, when

the control or management of investigation are transferred from one field office to another. In these instances, however, one field office will make commitments regarding party participation that are not recognized by another office, or might be forced upon another office.

We believe that a very helpful recommendation would be that any party to an investigation be required to submit a report to the IIC regarding his participation. It would certainly clear up the purpose for an individual being there where in some cases where it might be a little fuzzy.

We heard about critical parts being reused. I had to laugh when I heard this, because we have aircraft that are made of critical parts that are being reused. We use to refer to our favorite aircraft as "Spare Parts in Close Formation," but we cannot do that anymore, because it is a reality. We have probably 300 Bell machines out there that are literally spare parts in close formation. We do not believe that the FAA has been terribly aggressive in trying to correct the situation, and if I ever find out who the registration center reports to we might be able to have a system of identifying aircraft that had been reported as having been destroyed.

I am also happy to report that the NTSB is doing some work in this area right now. That way, you will not have to keep investigating accidents involving the same aircraft. It might be a similar aircraft, but not the same aircraft over and over.

We were told about air traffic control reconstructing profile and things of that nature. Again, a lot of this does not relate to helicopter operations. We have about 400 platforms in the Gulf alone, 2,000,000 operations a year, most of which are not conventionally controlled, or not controlled through conventional air traffic control techniques. Very little recording of transmissions outside the aircraft, and certainly not inside the aircraft. We certainly support the NTSB's recommendations regarding the requirement for cockpit voice recorders and flight data recorders aboard certain categories of helicopters. They need them perhaps more than anybody, but unlike the fixed wing, most rotorcraft accidents do not occur at or near the airport. This causes us a lot of different problems. We are trying to get crashworthy requirement data, and unfortunately, our best source now is the injury data. It is a gruesome way, and if you take this situation and have an autopsy that is performed by maybe an undertaker, as opposed to physician, it certainly aggravates the situation.

Again, you can have standards, but as long as you do not have any control over who is going to perform the autopsy, it is going to be very difficult to achieve the standardization. We found significant evidence that hypoglycemia has been a factor in a number of our pilot factor accidents. We do not get that kind of information through autopsy and the chemical analyses that are done.

We recommend that the FAA establish a procedure to to assure that manufacturers receive copies of recommendations related to subsystems of the aircraft. We talked yesterday about the importance of NTSB recommendations. I agree with that, but very often, for instance, we have the Bell 206 that uses a C-28 engine. We have several thousand of those out there flying around. We found out, I think, 4 months after the fact that a recommendation had been made involving the C-28 engine and we were not even aware of it. I think that is administrative, perhaps, but is something that could be addressed.

Many of the things that we talk about here, deficiencies, in some cases just beefs, are being addressed. I believe that the present Administrator of the FAA is probably the best qualified and most effective one that we have ever had. There are a lot of actions that are taking place that you are not aware of. To that extent I think that the FAA might improve their methods for letting people know what is going on. Significant actions in airworthiness with the result that accidents will not happen because of actions that are being taken right now.

The same is true with the Chairman of the Board, in addressing many of the issues that were discussed here that we are perhaps not entirely aware of. We hope to this extent, our comments and even our beefs might have been helpful in formulating and accelerating the actions that you are talking. Thank you.

Frank Harris
Cessna Aircraft Company

First of all, I would like to thank the Board for this opportunity, and the thoughts behind the purpose of the meeting. I am like Paul. I would like to get a better definition of the terms we heard yesterday, like Go-Teams, and things like that. Most of our accidents are handled by two or three people. Sometimes we do not know until we arrive at the site as to whether there is going to be a second or third person. So there are a lot of things that I am not qualified to speak on, but when it comes to the Cessna Aircraft products, we deal with the NTSB quite directly, and it is a real one-on-one situation. It has worked out very well.

Cessna, as a manufacturer, has an obligation to our customers to provide high utility products that will operate safely. Cessna wants to be aware of all the problems. In order to satisfy this need, Cessna relies on several sources for its information, one of which is accident analysis. Our effort is directed toward product improvement in new and existing aircraft.

We are aware that that NTSB is charged with the sole responsibility for the investigations of all aircraft accidents. We feel that Cessna is obligated to ensure that the government investigative agencies have access to pertinent Cessna information and technical data. During accident investigation along with the tools and experience we bring with us, the company has expressly instructed us to support the NTSB completely. We have no other purpose once we leave the factory.

As a part of that team effort, our final objectives are to support the NTSB investigator in charge, to tell the truth, and to work with the NTSB to seek the cause of the accident. We believe that generally onsite investigations are well managed in the field. The NTSB has people within their field organization that are very capable and very thorough.

We find, however, that there are some times when we are hampered in rendering as much assistance to the investigator-in-charge in the field. An example is the investigation with ATC involvement in an accident, especially with our type of airplanes. We have been excluded from the opportunity to participate in the investigation with ATC involvement on several occasions.

We feel that two heads are better than one, and in this case, a team effort to interpret information that is available, we may come to a better understanding of the facts. Besides that, we feel that the NTSB and the FAA are both supposed to have the same ultimate goal, which is good, thorough accident investigation, so why exclude us, or any other party to the investigation from significant portions of the investigation?

At the same time, we do not choose to participate in any activities which are intended to embarrass or highlight any department shortcomings during the investigation. When we feel somebody has the intentions for this direction, we just move to the back of the bus as far as we can, because this type of motivation always prevents good investigative results.

We also feel too frequently that we are excluded team members where there is a criminal activity in an accident. We feel that even though there is some criminal aspect

to the situation, the team should not be divorced of the normal procedures utilized during an accident investigation. In the name of safety investigations to determine cause should be blind to the criminal aspect.

I would like to interject that yesterday were talking about crashworthiness, and things like that which the Board was going to be more actively involved in. I do not know why, but we seem to find more people trying make landing fields out of the weirdest pastures and the roads and the trees and similar places. I think crashworthiness is a subject which has a library of information base on cases of operations where people have survived or just been hurt slightly and things like that. However, do not really have complete and total access to this information to this, and I would like to just add that to the considerations for the Board. Sometimes the information gained at the site of the accident is not made available to the parties representing manufacturers. This practice is not clearly defined as to when there is a limitation placed in the investigative parties. We find that different field personnel have their own interpretation. Such things as witness statements and aircraft files, log books, and maintenance records are usually collected at the accident, and are important to the investigation. However, they are not always made available to the members of our crew that is supporting the NTSB onsite.

We believe we should see all the factual data if we are expected to contribute a meaningful solution, because a clear picture is difficult to develop when pieces of the puzzle are withheld, and the economics of any department, company of group are such that we never have enough funds to do all the things that we would like to do. It is with this in mind that we understand the request sometimes to assist in recovering the transportation costs of wreckage, but this is not within our capability, jurisdiction or budget.

We want to support the NTSB, at the same time we protect ourselves from allegations of evidence tampering. We do not want to be alone with the wreckage. We do want to help if there is one or more of the team members observing or assisting us with the wreckage.

The question at any site is what caused this particular accident. Anything the team members can do to contribute to the inspection and analysis of the components at the accident are always turned over to the investigator in charge. We do not choose to try to distort or influence anything, because we know that there are never two accidents alike, and the cause of this accident at hand is probably unique.

We understand the NTSB is attempting to find the probable cause of the accident, and we can help a lot more if we are allowed access to all the information. It goes without saying that we need to arrive at the scene and report ready to get our hands dirty. It has been our experience, though, that some of the field investigators are a little more wary of delegating responsibilities and assignments. Maybe after a period of time, they will become better acquainted with our personnel and the rapport between us will improve, which will help in the delegation there.

In order to substantiate information in the NTSB reports, it is necessary for as many photographs as possible to be taken. We have found only a few instances where access to this information has been withheld. Sometimes the reasons for the limitation has not been defined. We hope those situations go away. It is unfortunate that they happen in the first place. It is also my view that we would like to see more photographs added and included into the part of the final NTSB report.

Not being acquainted with the NTSB investigator-in-charge brings about problems, especially in bringing up and pointing out significant findings. We try in every case to make certain that the investigator-in-charge understands what we have found. This is not always the easiest thing to do with a new investigator, and here again, we come back with the early communications in this area being a very vital key to that.

We have seen some postsite activity denied parties access. We find that we are left quite often without the information that develops after the team leaves the site, and, in our type of investigation, that would refer to witnesses which mail in the witness forms, and things like that, in some cases we do not even come home with the witnesses name. It may not seem important to you, but it is essential for us to see the whole picture to truly support the NTSB investigator.

This brings up the point of the reports that are released by the NTSB. Computerized NTSB brief format when it comes it out is of little or no value to us. We cannot rely on this type of report. In many instances it seems to release inaccurate information which is not supported by facts.

The final report, the Blue Cover Report, contains a narrative account of the accident and leads to the cause of an accident as the Board has found it. That narrative, if prepared hurriedly, can and does lead to different conclusions by different interest groups. We spend a lot of time and money disproving and/or interpreting these findings and recommendations, and we should not have to. The facts should be entered as found, and opinionated attitude and philosophy should not be in the report.

We wish the investigator's file could be reviewed by the team members earlier than the final report. In our operation we have had very few incidences of participating in a technical or in any other kind of review of an accident investigation. We feel this is a serious omission and would appreciate being able to participate in more of those reviews. Certainly, the type of accidents vary and we think the technical review, or any other type of review, should be flexible in its organization, but never overlooked. Accuracy is of paramount importance to all of us.

So hopefully, this seminar today will be an effective means of communicating between industry and government. It had better be, because communications appear to be about two-thirds of our job, yours and mine. Thank you.

Captain James A. McIntyre
Air Line Pilots Association

Mr. Chairman, distinguished Board members, staff and all participants, I'm going to open by saying I am in total sympathy with my fellow panel members who have discovered the thrill of operating machines that make their way through the air by beating it to death. I am scared of the damn things. My involvement in accident investigation goes back, of course, originally with the Navy.

In answer to the question of "what's a 747 captain doing on a general aviation panel," ALPA is involved in participation in aircraft accident investigation of Part 121 and 135 air carriers — the commuters. My rough remarks, therefore, will be confined to the Part 135 area.

As a matter of fact, these accidents are investigated primarily by the Bureau of Field Operations of the National Transportation Safety Board unless circumstances warrant a partial or full Go-Team involvement. ALPA has worked for years with the NTSB field investigators in major air carrier accidents and incidents. However, ALPA status as the official representative of the commuter pilot is fairly recent, primarily in the past 2 years, as a result of an ALPA Board of Directors action that permitted these pilots to join ALPA.

Some of the commuter airlines whose pilots have joined the association are Pocono, Air Wisconsin, Precision, Cascade, Imperial and others. Interestingly, one of the major factors that influenced their decision to join ALPA was their long-standing and recognized position in air safety.

As part of our air safety involvement ALPA conducts its own accident investigation course, geared I might add, primarily to the NTSB method of operation, and we are training these pilots as quickly as possible. However, the fact is, it is going to take some time to get them up to speed. In addition, the remarks concerning the limited facilities of the commuters as companies and their ability to respond to an accident investigation applies equally to the pilots.

If we pulled four or five pilots of a small commuter airline out of the line operation to participate in an accident investigation it would, to say the least, severely impact on their flight schedules, and in some cases would shut the airline down. What we are developing is a concept of mutual assistance whereby we can staff a full blown investigation by selecting individual pilot participants from several small carriers under the coordination of an ALPA National Accident Board member. In this way we can meet our obligation to assist the NTSB with people who are thoroughly familiar with the commuter carrier operations and the NTSB procedures, without overly impacting on any single carrier.

It will take some time, but we feel it holds great promise. Ironically, within 1 week of joining ALPA - and I hope it was not related to them joining - Pocono Airlines had a gear up incident at JFK. I was assigned to assist them. I worked with investigators at a New York field office. While examining the various records and manuals we discovered - and this highlights some of what the previous speakers have mentioned - that the hydraulics on the aircraft had been modified about a year prior to the accident. There was, indeed, a recommendation by the manufacturer to remove what is known as the spay

doors on the landing gear. These doors were originally installed to use the airstream to help pull the landing gear in the down and locked position. With the modifications doors became unnecessary for that function, and the recommendation was to remove them.

Somehow this information had not found its way to the commuter airline operators --any of them. Within days of discovering this fact a notice was sent to all operators to remove the doors, which represent at least a 900-pound reduction in drag. Reports from the commuter pilots quickly came back to us saying that it was like buying a new airplane. For example, on a practice single-engine on approach with the doors on or installed, if the pilot dropped the gear at the outer marker they simply could not stay on the glide slope, whereas, with the gear doors removed they were able not only to stay on the glide slope, but they were able to do it with reduced power. Thus, safety was quickly enhanced during the field investigation itself, and I applaud that function of the NTSB.

What are the concerns that have been passed to us in this area by some of our commuter counterparts? They are, one, there has been varying levels of expertise and attention by the National Transportation Safety Board and the FAA as its designated representative in accident investigations. They have ranged from excellent to pathetic, I am told. The primary reason seems to have been a lack of funds and training of the NTSB/FAA personnel. In some cases, a more indepth accident investigation was conducted by the insurance company who was involved in the litigation process than was conducted by the NTSB, and that is, indeed, pathetic.

However, we have noted — not that we are keeping an eye on you guys — but one of our people was at USC several weeks ago for a human factors course and in that course were four NTSB field investigators, and we applaud this. It is long overdue, and should be enhanced.

The commuters are most anxious, on the other hand, to have the NTSB exercise firm control over those accidents that are delegated to the FAA. Paradoxically, and contrary to my previous remark, they perceive this as a must to ensure a competent level of accident investigation.

ALPA also feels that the previously mentioned recommendation to go to a multiple cause finding concept in lieu of the single probable cause bears merit for Part 135 operators as well. In addition, it would also bring the United States into conformity with Annex 13 of the ICAO regulations. Believe it or not, Bar Harbor Airlines — not ALPA affiliated at all — crosses the border into Canada and therefore, is an international air carrier.

Most Part 135 accident investigations do not result in a Blue Book Report. Very often the report that is issued either gets to them very late, or not at all. At times it does not fully address the problems that they have faced. These reports need to be issued in a timely fashion to all parties concerned, and all operators thereby affected.

They recognize that the NTSB one-man field investigation has limitations and advantages. One of the advantages is the ability to quickly and concisely respond to their air safety concerns. I have just mentioned an example of that. This facet needs to be enhanced.

Quite frankly, the commuters need education in NTSB functions and procedures. They are presently intimidated by the process itself, on the level of expertise provided by the manufacturer and other parties. In the Pocono accident the owner, ironically a

retired Pan Am pilot, did not know that they could request interested party status. On the other hand, once tapped, their input was invaluable to the investigation.

In that regard, at ALPA, we have instituted a computer capability that includes tapping into the data resources of the FAA and others, and translating that into, I hope, accident prevention procedures, techniques and recommendations. For example, I hate to point this out, but this is a listing of the incidents on TWA for a 2-year period. We are using it to fight complacency among our pilot group, in that we are not having accidents, but by golly, we are certainly having some incidents. If we can nip them at that point, we are miles down the line.

For the commuter carrier, we also have the ability to not only tap into the incidents, but the SDR reports for particular aircraft. This could be invaluable as an accident investigation tool, to quickly survey the fleet that they operate and the problems thereby associated.

While I am tooling along in 747 on a non-stop from New York to San Francisco, or overseas, my commuter counterpart is making up to seven or eight landings in varying environmental conditions and at a wide variety of airports in the same day, such as the complexity of JFK and LaGuardia, or at airports in New Hampshire which may not have a control tower.

The commuters are the fastest growing segment of air carrier operations. They are dedicated to safety, I am convinced of this. However, they are also limited economically and in the number of people they have. It is not unknown for a young lady to be a hostess on board a commuter carrier for 2 days and the next 2 days she's pushing baggage, making the staff salute and plugging in the AP unit and selling tickets.

This forum, we believe, is an excellent example of the kind of widespread cooperation that is needed to ensure the traveling public enjoy safe reliable transportation throughout the entire spectrum of air travel. Let us ensure that it does not deteriorate into a Sunday sermon, let's go back to our old ways of doing business on Monday. Thank you very much.

ISSUE: USE OF RECORDERS AND AIRCRAFT PERFORMANCE STUDIES IN AVIATION ACCIDENT INVESTIGATION - "A Critique"

Moderator - Dr. Carol Roberts, Chief, Laboratory Services Division

Francis C. Rock	Federal Aviation Administration
Captain D.L. Leppard	Air Line Pilots Association
Mack W. Eastburn	American Airlines
Thomas F. Laughlin	Lockheed - California Company
Richard Bray	National Aeronautics and Space Administration

Francis C. Rock
Federal Aviation Administration

Good afternoon. I do not know whether or not I appreciate the opportunity of coming up here to speak about flight data recorder and performance. We know it is a controversial issue at this time. I would like to preface my remarks in that I will be limited to what I can say pertaining to the FDR/CVR, since we all know there is a large number of recommendations inhouse from the NTSB that have been under consideration, and recently, we sent back to the NTSB a letter saying that we would be looking at those recommendations again.

Currently, these recommendations were used as a basis for an evaluation report. This draft report has been completed, and I believe it is in the process of being forwarded to the Administrator for his comments. So my comments will be ones that will not preempt what he may be thinking, and what direction he may be going concerning the CVR and FDR on air carriers, and whatever aircraft are in the recommendations.

I had an early introduction to accident investigation work in the Navy. After the Navy I went to the Bendix Corporation, where I had the fortunate experience of working with instrumentation; and one instrument in particular—the flux state compass system. My first introduction to the commercial aspect of accident investigation involved an aircraft that apparently was in the weather and was following a heading. It turned out subsequently to be identified as a problem possibly with the flux state compass.

We at Bendix took the data from the flight data recorders back in the early '50s and finally resolved in a detailed study, that the accident was the product of the pilot following the heading information from the flux compass that had been accidentally caged. Somebody had hit the caging switch with their foot, and the pilot followed this heading thinking that he was doing what he was supposed to be doing.

This was the first analysis where I was acquainted with flight data recorders, and it took a lot of imagination to put this thing together. Since then I have been exposed to many, many more instances of this type of evaluation, even while working with Bendix.

I was assigned to the accident investigating team of the American Airlines. One accident at New York-JFK - Idlewild Airport at that time. The aircraft followed a peculiar pattern and ended up in Jamaica Bay at something like a 78 degree attitude. From the flight recorder we did try to establish some kind of relationship to the instrumentation at the time of impact. When we did establish a relationship, we found peculiar relationship between the instrumentation on either side of the panel to resemble the attitudes of both DGs and the attitude gyros. From that we were able to bring the aircraft from the attitude of impact all the way back to the runway by using the DG information and the DG itself. Now how many people would believe this was possible or this information was accurate? But that was one of the earlier days when we tried to put the performance of the aircraft and the flight recorder together. And we were satisfied that we had a fairly good representation as to what this aircraft did, and what it could have done.

So that brings us up to my association with the FAA. I was an avionics inspector in the FAA, and my first encounter with the CVRs and flight data recorders was an avionics inspector. I had to make an evaluation on the first CVR installation. The data on the recorder was supposed to be voice. In fact, the first evaluation I performed was on a Pan

Am 707 out of New York to Bermuda. We set up a script and went through some dialogue at various phases of flight. Takeoff, cruise, high speed cruise, high speed descent, approach and landing. The whole point of the evaluation was to evaluate voice recording capability. We went through the script, we timed it, and we had various discussions among the crewmembers at their positions and recorded the voice. That was all the evaluation was supposed to do. That was all the CVR was supposed to do.

I then left the FAA and went to the NTSB. I was involved in the CVR lab and flight data recorder lab. We did a lot of the ground work I believe that you see today. We had no spectroanalyzing and we had no graphics. We did the things by observations, subjective thinking and so on. We used the CVR and flight data recorder as a tool.

Since my early acquaintances with these tools - I have identified them as tools. They are investigative tools. They assist you in your investigation. They do not precisely give you the answers you are looking for, but they put you in some kind of a ballpark. From there you can go establish the metal related information.

During my time with the Safety Board we used the flight recorder and the CVR as accident tools, even using them as performance tools to give us a feel for what the performance of the aircraft was. I remember one, which was an airplane that crashed up in the technical center at Atlantic City. It did not give us a precise answer, but we were able to investigate what we heard on the CVR and go to the problem area. That accident was the result of a loss of hydraulics. Of course, loss hydraulics is not necessarily a catastrophic event, but this accident had other elements in it that did cause that aircraft to fall and lose control.

We were able to identify from the CVR conversation and the capability of the airplane that it had lost some kind of control, and the controls were something that the crew did not know about. They knew that they lost hydraulics, and they knew that they could not get the gear up or down, but there were other things that happened that were not known at the time. They were then identified and subsequently things were changed. Those things probably would never happen again.

We further progressed in identification of performance through the use of CVR and flight data recorders to today, where in the last two recent accidents, the Air Florida and the Pan Am, that we are attempting to use these tools again in a performance aspect.

On a five-parameter recorder this is very difficult to do. It is like trying to use the yardstick as a micrometer. You do not have those things you need to have, nor do you have the accuracy. But at least they give you something to work with. The expanded parameter recorders that we see on the post-1969 aircraft obviously are the ideal situation, with parameters up to 80 or more, depending on what the manufacturers want to put on for their uses.

Our requirements in the FAA is the five-parameter recorder for pre-'69 aircraft. The post-'69 aircraft must have the expanded parameter recorder. That is our requirement today.

As I said before, I will not attempt to preempt the Administrator and what he is thinking for the future of these recommendations that he has currently in hand. We do not know when he will be making these decisions, but we do know it was based on need, safety aspect and the economic impact.

We have not broached the subject of economic impact here at all, but we are governed in promulgating any rules by the economic impact to the user. There are certain requirements that we must respect and we must use as a basis.

The use of CVR's in general aviation aircraft was discussed earlier today, and some speakers felt that this was a tool that could be used to identify those problem areas. We would like to see a voluntary effort on the user to put these devices in the airplane. We are hindered by the economic impact studies that we must make to get these on airplanes. If we go out with regulation on those, the comments will be coming back in such manner that it will be a burden to the user, an economic burden to put it on, if not a burden in maintaining them. And it probably will be, to some degree.

The other area that I recognized this morning during these earlier discussions that I have been closely associated with is the glass cockpit. These are cockpits where the electronic display units, the flight management systems, the navigational systems are all computerized.

The next generation aircraft that will be coming out will probably have the glass cockpit, integrated flight systems, engine controls which are fly by wire, and which are totally integrated aircraft. No wires, no cables, no things to move or look at, and no switches to look at when that aircraft hits the ground. When you go out there you will be looking at glass, probably not even aluminum anymore, but some other material. How do we put that together? These are some of the things that we should be thinking about downstream for accident investigation.

The performance of the airplanes will also be different from what we see today. The modal deviation systems—the stability orientation systems will have different characteristics of aircraft than we knew yesterday—the heavy airplane, large tail surface and so on. The cause or the causes will not be as obvious as they were in the past when we went out looking at the hole in the ground.

Again, getting back to the FAA, having been to the NTSB, I used to think we wore the white hats then, and now I feel like I am wearing a black hat. With that, I thank you all for giving me your attention for a few minutes, and I did have a good relationship with the NTSB, they are doing a fine job, they are using the tools to the best that is available, and let's hope that they can get better tools and do as good a job with what they have. Thank you.

Captain D.L. Leppard
Air Line Pilots Association

Good afternoon, I would like to thank the Board for allowing us the opportunity to participate in this forum. I have a very short talk which I have entitled "Hypothesis vs. Fact, the Scientific Approach."

Those of us who participate or use flight data recorders in aircraft performance studies in aviation accident investigations are engaged in scientific endeavor, which, in a sense qualifies us the title of scientist. As a representative to the various segments of the aviation community then, let us each put aside the biases which we may have, and try to proceed as scientists for the next few moments. I would like to pass along a handy guide for identifying some of the various sciences that I came across the other day — the card says, if it is green or it wiggles it is biology, if it stinks it is chemistry, and if it does not work it is physics. As a physics major I can vouch for that.

Flight data recorder and cockpit voice recorder examinations definitely qualify as laboratory science. In the laboratory scientific endeavors are governed by four laws. They are known as Finagle's laws. The first law is, if anything can go wrong in the experiment it will; the second one, no matter what result is anticipated there is always someone who is willing to fake it; the third one, no matter what occurs there is always someone who believes that it happened according to his or her theory; and fourth, no matter what the result, there is always someone eager to misinterpret it.

In order to properly interpret the data we must develop an hypothesis. The formation of the hypothesis occurs after the observations from the cockpit. Now, this is very important. We believe that too often the Safety Board develops an hypothesis based upon prior experience and knowledge and then goes searching for the facts to support it, tending to ignore those facts which might discredit it.

It is probably impossible for anyone to free himself or herself completely from preconceived prejudices, but it is important to arrange the conditions of observations so that the observer's bias will not distort the results. This is not as easy as it sounds, and often elaborate stratagems are required to enable the observer put aside his own bias in order to be able to do the task. The value of the result depends upon the patience and the faithfulness to which the investigator applies to his hypothesis every possible kind of verification.

Having assumed the hypothesis, we must strive on the one hand to support it, and on the other hand, it is absolutely essential that we make every effort to upset and reject it. The method of agreement states that if all circumstances leading up to an event have one factor in common that factor may be the sought after cause. This especially so if the factor appears to be the only factor in common.

The difficulty lies in the fact that it is very difficult to be certain that that factor is the only factor common to the circumstances. A scientist was very liberally enjoying his scotch and soda at a party one evening, and the next morning found him feeling rather poorly, so he switched that night to rye and soda instead. He woke again with the same distressing symptoms, so that night he switched to bourbon and soda, and once again he awoke feeling as poorly as before. The scientist concluded that he would not longer drink soda in his drinks, since that was the common ingredient in the three observed cases.

Often an hypothesis can almost always be constructed to fit a given set of circumstances, and if we can demonstrate this mathematically we can surely demonstrate it philosophically. For example, take the following series of numbers, 2, 4, 6, 8, 10, 12. This series is described by the simple formula 2N, and then obviously the next set of numbers should be 14, 16, and 18. But wait, a much more complicated formula also fits the same series of numbers, and if you follow that formula then the series becomes 2, 4, 6, 8, 10, 12, 7, 34, 50, 56, etc. I say that to show that the obvious answer may not always be the correct answer. For this reason few scientists would claim that any hypothesis, however extensively tested, is a statement of absolute truth.

In the light of all that I have said about testing hypotheses, I would like to point to only one example, that of Air Florida, Flight 90, here in Washington. ALPA was generally pleased with the quality of this investigation and the report. But I believe that portions of the analysis revealed a flaw in a broad scientific accident analysis procedure.

I would like to discuss three areas in the investigation. The flight simulation, the engineering analysis and the spectroanalysis. A pilot's reputation is built primarily upon his possession of two attributes; his judgment and his manual flying skill. The pilot in this accident had his judgment called into question. The hypotheses listed a test of science, his decisions not to get deiced, not to use engine heat, and not to abort, may have made the accident inevitable.

Had he elected to abort early enough the accident clearly would have been avoided. No quarrel there. But this pilot was also censured with respect to his basic flying skill. It is to this hypothesis that I wish to speak.

Let's first look at the section of the Board report which reads, "The flightcrew had sufficient control authority to. . .and stabilizer trims to overcome the pitching moment, reduce the pitch attitude and accelerate to a. . .and climb out successfully." Now let's look at the flight simulation on which the Board conclusion appears to be based, again from the Board report. "The simulator was programmed to represent conditions of no-ice and ice contamination of varying degrees. Data for the latter were derived from wind tunnel and flight tests using corn ice 30-grit sandpaper."

Note that only the coefficients of lift and drag were used to program the simulator for ice accumulation. This gives me two problems scientifically. First, pitching moment due to ice accumulation was guessed at, and then held constant and not varied throughout the series of tests.

Second, corn ice normally forms during flight due to moisture particles striking the aircraft and freezing on the surface. Had the ice involved in this accident been corn ice, we would have no way of determining how much or whether 30-grit sandpaper was representative of the roughness of the ice on the wings of Flight 90. In fact, this ice was apparently formed as a result of snow melting on the static wings and then refreezing. This kind of ice is not normally corn ice. Thus, it appears that with regard to ice accumulation, the data used to program the simulator was not truly representative of the accident aircraft.

Now let's examine the pitch data used in simulation. We know from the Board's analysis that the pitch angle achieved by the aircraft had a large effect on flight drag and hence, a vital effect on the aircraft performance. Yet, we do not know the actual pitch angle achieved by the aircraft.

Was the angle of attack due to pitch up greater than the simulated 18 degrees? The aircraft got the stickshaker but the simulator did not. If the aircraft angle of attack was greater than 18 degrees then we must consider additional parasitic drag, resulting in additional thrust requirements. So we do not know.

Were the results of the simulation similar to the real world in spite of this? What happened in the real world? Engine stall out occurred at 1600 and 37 seconds and the sound of the stall on stickshaker began 2 seconds later and continued to impact. At 1600 and 45 seconds the captain said "Forward, forward." At 1600 and 50 seconds the captain continued, "Come on, forward, forward, just barely flying," apparently in spite of the forward pressure on the control, at least by the first officer. The stickshaker continued to operate.

Well, what happened in the simulation? I quote again, "The simulator pilots did not on any flight spontaneously activate the stickshaker in the programmed pitching moment. To activate the stickshaker and keep it activated simulator pilots had to hold positive back stick force, in some cases 10 times or more. If the back stick force was released during the first 10 or 15 seconds of flight the simulator would fly out of the stickshaker regime."

Note that in the simulation all the pilots had to do was let go and the simulator would fly itself out of trouble.

Was the simulation representative of Flight 90 with regard to pitch? Let's get it straight from the Board report. "Thus, although airplane behavior in terms of final acceleration performance could be simulated and valuable information derived from these flights, pilot control force responses were not necessarily representative of Flight 90. Variations in aircraft pitching moments may have needed stricter control forces and pilot responses."

So it would appear from the Board's analysis that the simulation was not truly representative of Flight 90 with regard to pitch, as well as with regard to ice accumulation.

One last item. As any professional in charge of a lab class knows, data which is massaged so that the experiment will work out as the student knows and is supposed to, is called fudged data. The Board published the following table in their report to which I have added impact time and also a report-found flight condition for verification.

The portion of the Board's case for lack of throttle advancement appears to be based on two points, those at 1600:39 and 1600:50. At 1600:39 the blade passing frequency, or BPF, was listed as indistinct. This was due to the masking of the BPF or the sound of the stickshaker and changes in the CVR tape speed. But if the BPF was indistinct what scientific justification do we have for declaring that it was probably stable, or that the EPR was at 82 percent? We believe that is fudged data. Finagle's second law.

Now what about the point of 1600:50 seconds, the point upon which much of the Board's case for lack of throttle advancement is built? This finding was evidently a result of an eyeballing. This view shows the spectroanalysis performed by the Board and additional throttle advancement is shown here, up the graph in time until we reach full power, or full power that was reached at approximately 82 percent.

And now we continue with our N1 speed on up the V2 certified here, on up to the onset of stickshaker which occurs about here, and from this point on the spike starts to become very cloudy. This is the final chart, and this is the chart on which the information was based that the crew applied the power 16 seconds after takeoff, and as you can see, as far as I am concerned, this is really plain mud. I do not see how any really useful information can be derived from this graph.

Boeing, however, also did a spectroanalysis. Theirs was accomplished in a noise technology laboratory using a frequency analyzer. Part of frequencies obtained by Boeing using the graph of BPF versus N1 speed in the Board Exhibit 12-B in the hearing produced the following table of Boeing results.

Please observe that using a frequency analyzer and a computed spectrum, Boeing was not able to obtain any information regarding engine speed from shortly after a report of V2 until 3 to 6 seconds prior to impact. Let me quote directly from the Boeing report. The figures 10, 11 and 13, show no compelling evidence in the acoustic data for selecting any particular spike as being associated with airplane engines.

Ladies and gentlemen, the data point on the Board's report is 1600:50 seconds, which is the only data point between approximately V2 and 60 seconds prior to impact, appears to us to have been fudged. It is apparent that the Board was not confident about this shaky evidence. Let me quite the Board's misgivings." The frequency recorded on the CVR which corresponded to engine rotational speed was not distinct on the sound spectrogram after the aircraft stickshaker activated. Although a transient frequency which may have been associated with an increase in engine rotational speed was discernible at 16 seconds after stickshaker activation, the Safety Board does not believe this to be sufficient evidence on which to base a positive conclusion that the crew waited 16 seconds before pushing the throttles forward. The Board does believe that power was added before impact."

The Board's primary case was an engineering analysis. And I quote again, "However, since the engineering simulation showed that had full thrust been added immediately following the activation of stickshaker the aircraft would probably have accelerated to a safe stall margin and continued flying."

Were there unknowns in this engineering analysis which would tend to render the appraisals invalid? Yes, there were many. The type of ice, the amount of ice, the roughness of the ice, the position of the ice on the air foil, its effect upon the air foil, the flight characteristics of the air foil and the pitching moment of the Boeing 727 air foil with the ice accumulation. All pieces of missing information vital to the analysis. Yet despite this incomplete and highly questionable scientific evidence the Board concluded the following.

"Based upon the engineering simulation the Safety Board concludes that even if low thrust during takeoff were known. . .the accident was not inevitable as the aircraft lifted off. However, both immediate recognition of the situation and positive effective actions by the flightcrew to both counter the noseup pitching moment and add thrust were required. With these actions the aircraft should have been capable of continued acceleration and achieved sufficient performance margin to climb."

There should have been. The simulation merely showed that the simulator, programmed as it was without the vital ice accumulation and pitching moment data, could

fly out of the predicament, and the engineering analysis lacked the data vital to the validity of the equations.

We have no conclusive scientific evidence that the crew did not do exactly as the Safety Board said that they should have. Members and staff of the Safety Board, you wield a mighty sword and thereby have an awesome responsibility. While we may disagree with your results, we do not question your integrity. When you speak the world listens, and the world believes.

Let me show you just a couple of examples. The following was written by Mr. John W. Alcott and was published in the Business and Commercial Aviation, October, 1982: "Had the crew applied full power simultaneously with lowering the nose properly after becoming airborne a successful recovery would have been achieved. Thus, when the crew finally added thrust the plane was near. . .aerodynamic stall and. . .climbout recovery was impossible."

And now the World of Business and Commercial Week and from an article in the ALPA Pilot from Mr. Thomas Horne, says that the crew waited too long to apply power.

"The NTSB stated that the accident could have been avoided if the crew had responded with an immediate increase in thrust. Simulated tests showed that the airplane could have climbed out of its predicament if only the thrust levels were advanced to maximum power."

And now the World of General Aviation, August 18, 1982, "tests on the Boeing simulator indicated that the pilot could have saved the aircraft by applying full thrust when it began to stall a few seconds after takeoff."

And the general public, if you read Aviation Week during this period, you might remember many of the letters that were sent into the editor castigating the crew for not advancing the throttle. The world of commercial aviation also believes. All of these people's belief is based upon what we consider to be fudged evidence, mere hypotheses masquerading as fact.

Ladies and gentlemen of the Safety Board, you have a moral obligation to prevent the reputation of a pilot from being destroyed by a more hypothesis which has not been subjected to all the tests of science and is masquerading as fact. If you will honestly and faithfully evaluate each and every hypothesis which you develop I believe that all of the causes of most accidents will be revealed. The aviation community will be even further in your debt and flying will be safer for us all. Thank you.

Mack W. Eastburn
American Airlines

Good afternoon. My comments will not be quite as lengthy. On the opening day there was some discussion of world flying hours and accident rates. I would first like to add to this information.

While we are great in safety within the U.S., if you look at the world record you will see that the U.S. flys 95,000,000 hours last year, all the rest of the world flew about the same number of hours, ever since the introducation of the jets the rest of the world has lost twice as many jets as we have. Going a little further, you break the accidents down, the hull losses by where the carrier is based, the geographical area, you will see that we are not number one. We are surpassed by a wide margin by Australia, New Zealand, the so-called Australasian areas.

To look at it a little further, you will find that there are three areas in the world with good rates, Australasia, the United States and Canada. These are the three countries that have strong regulatory bodies, and I say, if the rest of the world wants to improve their safety rates they had better improve their regulatory bodies.

In that regard, I want to thank the Board for inviting me today to be able to criticize, without limitation, critique, make recommendations, to what we believe they should be doing.

The area that I was asked to talk on was the use of the recorders and the aircraft performance data. I believe along with my counterparts with the rest of the major airlines within the United States, that we have no problem, and we want to tell the Board that, within their limitations, they are doing an excellent job.

There is one concern, and that is with the new rule on release of the recorder information which must be retained for 60 days, and in this regard we feel the rule seriously deprives the field investigating team of valuable information. We would recommend that it would be changed. Thank you.

Thomas F. Laughlin
Lockheed-California Company

I am here to present the views of the industry, and if my views are controversial, they are my views. If they are not controversial, I am speaking for the rest of the major manufacturers. Now, before I get into a discussion of the CVR and the FDR debacle I would like to offer my experience with a topic that was discussed yesterday to some small extent, and that is when do you talk to the flightcrew after an event.

I personally was involved in two very opposed circumstances, one in which a commercial airplane with a load of passengers took off and, in the conduct of a very short flight, the cabin went from sea level, to 35,000 feet, to minus 22,000 feet, back to sea level. We talked to the crew 4 weeks later and they had an eloquent statement. It was all wrong, it turned out, but it was eloquent.

The diametrically opposed circumstance was one of our high performance jets landed somewhat short of the threshold 1 day, and it created quite a stir. The pilot, in his anxiety to park the airplane, and not knowing what was going on, left the area rather quickly. When we arrived the pilot was standing a couple hundred feet from the airplane, which still had the engine running. Since the gear was up, the engine was sucking up sand and sagebrush and throwing it all over the desert. We, being typical investigators said, "Ray, my God, what happened?" He said, "Beats the hell out of me, I just got here myself."

So you can see there has to be a happy medium somewhere. I would like to reinforce the feelings of, I think, many people here that the CVR or the FDR are not the solutions to an accident. They are tools to be used by an investigator, and in that regard they are extremely useful to us. With the advent of the more sophisticated recorders we can very easily confuse ourselves with data. We have got so much data at times that you really get mired down in trying to analyze what may have happened.

I personally believe that the onsite investigation could benefit greatly if DFDR or FDR and CVR information were made available as accurately as possible to the investigators on the scene. It would help them to direct their investigation toward areas where more resources are required and will eliminate a lot of useless effort out there thrashing around looking for bits and pieces.

It has also been my experience, and just very recently, that reading a transcript can lead you to one conclusion, and when you listen to the tape it is a totally different conclusion you reach.

We had a case where the transcript attributed the word "hydraulics" to the captain, and the response, "okay" to the flight engineer. We puzzled over that for some time. When you listen to the tape, it was the captain who said "hydraulics," but he asked the question. He said "hydraulics?" and then he responded to himself, "okay." It totally changed our perspective of what we were looking for. We need that information, we need it early, and we need it on the scene. With regard to the security of DFDR and FDR information, and CVR information, we in industry have other problems that security is involved in, and we use a very basic tenet — the need to know. If you really have the need to know and you are considered a qualified, capable representative, you certainly have the moral and ethical background to hold that data secure. If you do not, and the leak is

attributed to you and proven, you ought to be removed from any further accident investigations as an active participant.

We have worked closely with NTSB over many, many years in doing DFDR and FDR analyses because we believe that when you get into extremely detailed performance analysis, we the manufacturers, have at our plants, all the necessary people and data required to perform the analysis. We feel that the NTSB certainly should produce computer graphics — and I am very happy to see them going to computer graphics. I think they can take a good lesson from Transport Canada, which has a very eloquent computer graphics system where you get a perspective and feel of the airplane in flight with its path projected on a grid in scale so you can determine height and ground track. Computer graphics enables you to display at the same time the applicable flight instruments and other CRT, and furthermore, if prodded sufficiently, it can correlate the CVR and listen to the whole event in real time and see the actions of the airplane in perspective. I think it is a great tool, and the NTSB, if it can possibly do it, ought to include this task in their operations.

We truly believe that where sophisticated analyses are required, that we are in the best position to perform it. We invite all parties on the scene to the facility. We certainly have always taken our direction from NTSB committee chairman or the IIC. We merely provide our facilities and the talent to help him in his task of putting together a rational real world situation. Many times this is extremely difficult. One of the reasons that we believe that we are in this position is that we not only have the data, but we have the background on the development of the airplane and its growth pains.

I will give you some examples. We had an in-flight fire almost 3 years ago. There was a lot of concern, since the airplane was full of passengers, that we could get a pretty good clue on where the fire was. It was a cabin fire. We had a CVR tape which was a combination of English and two foreign languages. We had passengers on the PA system. It was a bit of a debacle.

We undertook to do a center of gravity study on the airplane in-flight based on some DFDR data that got read out. In order to do this you have to know the airplane's stability characteristics, you have to know the response to elevator trim. It turned out that the calibrations had shifted on the DFDR. We had to recalibrate the DFDR by using some tapes of a previous flight, but by careful analysis we came up with — and I will not say a scientific precise CG evaluation — but we did determine that it was entirely possible that a group of passengers had moved forward at one portion during the flight and had returned approximately to the area where they started at. They did not get all the way back. Anybody who did would have been an absolute fool, but we were able to do that, and it did help us greatly in the determination at least to a degree of the sequence of events.

Now, it was mentioned you want to be careful not to use a yardstick as a micrometer. You also want to be careful not to use a micrometer to measure a marshmallow, and we try to do this from time to time.

Another type of study that we had to do that was quite difficult had to do with whether or not an autopilot was engaged, and what mode it was engaged in. In order to do this, you had to look at the response of the stabilizer, you had to look at the corresponding response of the stick, you had to know the control system, compliances and cable stretches and bungee stretches, and by careful analysis attempt to be scientific and unbiased. I might add, we concluded that it was most probable that the autopilot was

engaged in a particular mode. We had no other way of knowing. And this had some bearing on the eventual determination of a probable cause, not the probable cause.

I believe that as in any investigation like this where you are trying to do FDR or DFDR data you must have access to the CVR. Doing one without the other is a very, very difficult task, particularly if you are getting into airplane aerodynamic control or configuration problems. I think that the particular people involved in these analyses should be ingrained with the need to know and the requirement for maintaining high security in this area.

Now, I have a few comments I would like to make on the improvement areas. First of all, I think we need data on the scene quicker. We need it accurately, though. We do not need it quicker with a lack of accuracy, and it is not all that difficult, even with the old five channels. It would have helped me personally a number of times if I had a common time base I could work with the DFDR and the CVR. You find it sort of frustrating when you have to take an ATC tape and listen to the time on that and find the corresponding transmission CVR and then find a blip on the DFDR and tie it together and then you go 40 seconds downstream and the times do not match anymore.

With our technologies we certainly ought to be able to get a common time base. I have a clock here that keeps time accurately to the second in 6 months and it only cost $29.00. We ought to be able to feed that kind of information into these systems so that we can at least correlate to a reasonable degree.

I think it is time that we, as an industry, looked at the DFDR parameters that are required. I am not so sure we need all the sophisticated ones we have, but I think there are a lot of others we could really use.

For example, how would you like to have cabin altitude if you had a pressurization problem in the particular case that I mentioned earlier where the airplane, where the cabin did some wild excursions?

The previous owner had had cabin altitude on the DFDR, and we were able to see this thing. By very careful analysis of outflow valve slewing rates versus outflow valve areas, we got our pneumatic readings together and we figured out what really happened. Something different than the second officer said happened.

I personally would like very much to see some discreets on autopilot modes. Autopilots these days are pretty sophisticated. We have various command modes. We have control wheel steering — if we have an accident or an incident you do not have the foggiest notion what that mode was. It would be very, very easy, and I think we ought to take a look at that.

Since I have had to construct over-the-ground-flightpaths, one of the most eloquent ones we did was based on a photograph in Life magazine. We could not get any other data. We went out and bought two copies of Life and sat down one Saturday and developed the Eastern flightpath of the Boston bird accident.

It would save a whole lot of trouble if more airplanes were equipped with INS. You can generate windshear out of that data easily with a simple computer run. Another area is for stopping performance. We ran some tests under the auspices of the FAA a number

of years ago where we tried to define wet runway performance, which I might add 22 years later we are still trying to do. We are getting closer. In those tests we were measuring brake valve pressure and we were measuring air skid brake pressure. Brake valve pressure said the pilot had the brakes on. You bet — 3,000 psi. The brakes did not know that, because the air skids were releasing and we had a couple hundred pounds at the brakes and the airplane was rolling merrily down the runway unrestrained by any activity.

If we are going to put that kind of material on DFDRs, let's get together. I think perhaps it is time for industry, the FAA, and the NTSB to get together and reevaluate what we really need, what is useful to be on the DFDR. We have a lot of experience now that we can go fall back on. In our case, we have a lot of data that — millions and millions of data bits that are completely worthless.

Anyhow, with that I would like to close, but before I do that I would like to relate an experience with human factors. We had one of our more daring test pilots flying a very high speed helicopter over a dry river bed. Without realizing it he encountered a high tension cable strung across the dry wash, and the only damage to the airplane was a broken cam.

In the investigation we cornered our pilot, and we asked him to fill out a questionnaire. One of the questions was would you be willing to take an accident proneness test. His response was, "No, I already know how to have accidents."

Richard Bray
National Aeronautics and Space Administration

Good afternoon. There are a few of us here representing a government aviation agency that have not received any heat yet. Maybe we are just not trying hard enough.

At Ames we were first introduced to the CVR and flight data recorder about 20 years ago, when we got into a national program studying what then was termed the jet upset problem. We tried to apply our fledgling simulators to that task, and of course, we had our first dealings with the shortcomings of the flight data recorder, the shortcoming of available airplane descriptive data which is necessary for that kind of work.

We were really doing human performance analysis as well as airplane analysis. That was the reason for doing real time pilot and flight simulation, and we very seldom came out with a positive definition of what had happened, because of these shortcoming. However, we did get some good indications that those problems were not due so much to the airplane perhaps, the type of airplanes, but the fact that the operational envelopes had increased so rapidly relative to the pilot's experience, going from 20 to 40,000 operational altitudes, 450 to 900 feet per second inertial velocities, and of course, the other mysteries of transonic flow.

I think we are seeing a little bit of the same thing happening again in general aviation accidents for the last few years. But of course, we got involved with some of the engine-out training accident investigations, and we again, got more or less general answers. We saw that the pilots were facing hazards that were not fully appreciated. The general recommendation to limit engine out training near the ground to a minimum came out of those types of efforts.

By the time the next major category of accident came along that we got involved in which — the windshear accident on landing or takeoff, we were out of the formal accident simulation business. The airplane manufacturers had their own development simulators, and insisted on assuming responsibility for the accident simulation when it was advised. But we did have the opportunity to participate in these analyses and in some of the simulator demonstrations as consultants to the Board.

By this time, of course, the digital flight data recorder had appeared on the wide bodies, a mighty step from the ridiculous to the sublime. However, the law of averages prevailed, and the Go-Teams most often got out of bed to go try to find the foil recorder. Nobody could have planned a better comparison of the two capabilities of these two recording systems than occurred at Kennedy in 1975.

An L-1011 neatly mapped a thunderstorm outburst in a struggling go around and a few minutes later a B-727 failed to make it in what was presumed to be the same or similar phenonemon. What if the L-1011 had not been there? What kind of assumptions would have been made on the basis of those four scratch lines on the foil from the B-727? What if the L-1011 had done its thing but the B-727 got stuck in a holding pattern somewhere? Would the L-1011 captain had his data dumped for posterity? Probably not, because he did not have time to read his manual as he dealt with this situation, and the story might be better in the telling than in the showing.

I think that we sometimes pay unnecessary outrageous prices for our knowledge. You might perceive that I have a few gripes, a few recommendations. In no particular order I will relieve myself of a few.

I think the foil recorder is a frightful anacronysm, closely relative to and like a can opener to a modern data system. It has been around for nearly 25 years, and for some 12 of those years these contraptions have been going into new aircraft on one assembly line while on another where the big fellows are being built something good has been happening.

I do not see any realization for this, and who is responsible? Well, I think we are forgetting who is responsible. The NTSB has pushed for something better, of course, as recently as last year. I think it is again past time for us to try harder to get the FAA and the operators to take some of the mysteries out of accident investigation, because they are sometimes very expensive mysteries.

Secondly, at the present time the manufacturers are providing us performance analyses and flight simulations based on the flight data. I think the NTSB must find an additional source for this work. I thought I was being quite objective when I was doing this thing some years back, but with the incomplete nature of the recording data on the airplane description, I occasionally found myself using unreasonable body English on the uncertainties to support the most attractive hypothesis.

Certainly, the manufacturer cannot be expected to go to great lengths to build evidence against his own interests. Some fine simulations have been made by the manufacturers, but they have not generally been characterized as unfettered, wide-ranging exploration, at least not for publication, and this is an area I think Bud Leppard brought up.

Thirdly, in some cases the results of performance analyses are extremely dependent upon assumptions, such as to power setting or the nature of aerodynamics beyond the stall. Of course, my favorite example occurred several years at Atlanta. A B-727 ran into trouble during an approach, descended very rapidly from 800 to 300 feet before recovering with overboosted engines. Because of the strong interest in windshear, this incident was a subject of an NTSB report, but with only the foil data an identification of the shear depended strongly on the assumptions regarding thrust during the event. Basing their assumptions on the actions recorded by the crew, which reflected very strong familiarity with their operating manual, a downdraft windshear of magnificent proportions was defined. The considered review of the evidence would support a more normal disturbance coupled with less than optimum pilot performance. Unfortunately, the severe model reported has been used repeatedly by some parties as evidence of the inadequacies of the low level windshear alerting system.

I think my last subject here is more of a lament than a gripe. I hate to think of all the very valuable data that has evaporated off the end of that 24-hour memory on the digital flight data recorder. It seems we have to hurt somebody to get those data back, as in the case of the L-1011 at Kennedy.

We saw some very interesting data in the last 2 years obtained from DC-10s that encountered high altitude turbulence, knocked the people off the overhead, and were reportable incidents. The data was analyzed and we see some remarkable evidence of vortices with vertical velocities of plus or minus 100 feet per second, the kind of data that should really delight the meteorologists and perhaps give pause to the operator.

Well, these are some gripes, and I have one more general recommendation to the Board, and that is to call on more support from NASA. I think maybe the top people you will contact might squirm and dodge a little bit, complain about budgets, but I will bet

they will come through. Certainly, the working groups will enjoy the opportunity to temporarily join your cause. I know I certainly have enjoyed the association. Thank you.

ISSUE: HUMAN PERFORMANCE/HUMAN FACTORS IN AIRCRAFT ACCIDENT INVESTIGATION - "A Critique"

Panel 1:

Moderator - Gerrit J. Walhout, Chief, Survival Factors Division

Dr. Delbert Lacefield	Federal Aviation Administration
Gary Babcock	Air Line Pilots Association
Linda Foran	Association of Flight Attendants
Delmar M. Fadden	Boeing Commercial Airplane Company
George I. Whitehead, Jr.	Piper Aircraft Company

Panel 2:

Moderator - Ronald L. Schleede, Chief, Human Performance Division

Dr. Andrew Horne	Federal Aviation Administration
Captain Richard Stone	Air Line Pilot Association
Dr. John K. Lauber	National Aeronautics and Space Administration
Captain Rod Gilstrap	United Airlines

Dr. Delbert Lacefield
Federal Aviation Administration

Good afternoon. I would like to express my appreciation to the Board for inviting me to come here and share with you some of our experiences over the last 15 years.

To give you a little background of our interest in human factors, we started our program 15 years ago at the encouragement of two former directors of the Armed Forces Institute of Pathology. They recognized that the Civil Aeromedical Institute in Oklahoma City was basically a research institute and had a great deal of expertise on the staff, and was centrally located. In the ensuing 15 years we have been involved in 4,800 fatal accidents. There is nobody in the world who has as large a data base on fatal accidents and pilots from those fatal accidents as we have. Now, almost all of these have been from general aviation accidents. We do get involved in all the larger accidents, too, but fortunately they happen rather infrequently in this country. In nearly 40 percent of these cases we are able to come up with something — many times positive, but also sometimes negative — that will give a cause or a factor to an accident.

We have heard the figure 80 to 85 percent repeated in the last couple of days in fatal accidents as being pilot error. If it is the case, I think that we should probably spend more time in our accident investigations looking at the pilot from the human factors, and particularly the medical standpoint, than we do. But that is not the way we investigate accidents.

There is probably no other single area of investigation that will yield as high an answer as the program that we have in Oklahoma City. Occasionally, we dispel preconceived ideas of accident investigators in the field. As you know, many general aviation accidents happen close to home, and if a local GADO man is part of a team investigating it he may know that pilot. He may know the pilot's reputation, and if, in that wreckage, he finds some beer cans or a broken whiskey bottle, he has a pretty good idea of what happened. Many times it is not the case, and we have to get on the phone and call the investigator and say, go back and look for another cause of the accident because we just simply could not substantiate what you thought was the cause of the accident.

Unlike the NTSB, the FAA has a rather large medical capability and support for our program. The FAA has some roughly 7,000 aviation medical examiners, primarily for medical certification, but the majority of the aviation medical examiners have indicated a willingness to us to participate in accident investigations. Because of the very different nature of aviation accidents in comparison to what we see in the morgue, we realize we needed to train some of these aviation medical examiners. Two years ago we instituted a program where selected AMEs went to Oklahoma City for a week's intensive training in the medical aspects of accident investigation. We have now trained about 85 physicians, and at least one in almost every State. In addition to that, of course, all of our regional flight surgeons and assistant regional flight surgeons have taken the same course. We have placed special emphasis in our training course on incapacitation of the pilot, survivability of accidents, and the correlation of the body with the machine, or what has commonly become very popularly called crashworthiness.

Now, there are usually pathologists within a few miles of almost any aircraft accident, but field investigators have learned from experience that sometimes they do not

want to use these people. Therefore, they get the samples and send them to the laboratory in Oklahoma City to have them worked up.

Our Toxicology Laboratory, of course, is the backbone of the entire program. Our work has produced some rather notable things. There was an accident in Anchorage, Alaska, in which 80 some people were killed. One pathologist did a very thorough job on each of the victims in this accident and made some brilliant observations. He sent blood samples to our lab and, for the first time, carbon monoxide and cyanide was measured in the blood of of all these victims. Well, we came up with a lot of pieces of paper with a lot of numbers on them and we frankly did not know what they meant. We realized that this problem should be addressed and an answer should be arrived at. So the problem was assigned to one of the chemical groups, and they instituted very basic research on toxic gases that are produced in fires. This was the beginning of what we hear so much about. Within a period of about 2 years — these things can not be done overnight -- this group was able to give us an explanation of what these figures meant.

Now, I will have to admit that we have limited resources and limited people. Even though sometimes problems are very interesting and we would like to be able to give you an answer, many times we cannot. This same group devoted probably a year's time very recently to what appeared to be a toxic gas problem in some twin-engine jet aircraft that were crashing, but simply could not come up with an answer. Frankly, neither could anybody else.

So in research work you do not always get the answers you want, but we do have that capability. We also are very fortunate in that the medical records of all pilots in the United States are kept in a building adjacent to ours. It is amazing that in going through medical histories of pilots what you can pick up, if you have a background in medicine and know what some of these little things mean. It many times leads us to prior hospital records and things like that.

I think the important point of all this is that you need to know from the human factors medical standpoint what is needed, what can be done, and what has meaning. NTSB has recently proposed to expand their capabilities in this area, and have their field people coordinate with local medical authorities and laboratories to have this type of work done.

We have found that local laboratories can give you very misleading information, and their interest and knowledge simply is not in this area. After all, the coroner or medical examiner's job is to sign the death certificate and list the cause of death. In any airplane accident it is very easy to say that somebody died from trauma as a result of an aircraft accident, and that will satisfy all the State laws in this country.

There are many States in which we cannot even get the State medical examiners to take the bodies of aircraft accident victims. It is too simple. Anybody can sign that death certificate. They are also a little bit frightened. The bodies that present themselves after aircraft accidents are not like suicides, they are not like homicides. When you have drugs in the tissues of a pilot they are usually there because he is being treated by a physician for a medical condition. It is not an overdose, he did not commit suicide, and this is what our coroners and medical examiners see. It is not real easy.

We do not see the so-called overkill. Some of you may remember the accident that happened in Chicago at Midway a few years ago. I have hanging on the wall of my office the headline out of the Chicago newspaper that says that the coroner bungles probe. Well,

there is probably no place in the United States where medical examiners sees more dead bodies than Cook County, Illinois, and cyanide is not an uncommon thing either to kill yourself with or for somebody to use to kill you. Yet they published information that was physiologically impossible. When we call it to their attention on the telephone, and we were the one who detected it, they say it was a typographical mistake, so they issue a new report. When we finally saw the new report, we found that there was such a small amount in these people that no analytical method in the world was capable of detecting it.

I think you have to take any aspect of accident investigation totally unbiased, do a complete job on it, and let the chips fall where they will. This is one of the problems that you run into, and if you cannot trust the Cook County, Illinois, lab, then you will have a great deal of trouble in Billings, Montana. So you have to be very, very careful in who you're going to use.

You need to have somebody that is extremely familiar with being able to talk the language of people who do the work. There are lots of ways of doing all of these tests, and certain States, by law, prescribe certain way, and they are fine on living people and nice clean samples. But those of you that have seen the type of tissues and blood samples that you can get from victims of aircraft accidents realize that these are not very nice samples. There are a lot of methods that will work on those hospital samples, but they simply will not work on the samples that we have to deal with. People are dead, and these are completely different from the samples from living people. You may remember, for instance, a little over a year ago the plane that crashed on the deck of the carrier at Norfolk, Virginia, 17 young sailors killed. About 2 weeks later a report came out that 15 of them had been smoking marijuana. Well, it turns out that that test was done on the urine of these individuals. Marijuana is excreted in the urine for 30 days. We do not know whether any of those boys had been smoking marijuana within the last hour, and that's all the longer it has an effect on you.

So you have to be very, very careful of what you get and how you interpret it. You have got to know what has meaning, and you must verify numbers that come to you on a piece of paper by field investigation. But this cannot be done too quickly. In talking about interviewing surviving pilots and things, maybe you want to wait a week or so, but once you have a dead pilot you want to do all of your interviewing of associates, spouses and things like this as soon as possible, or you get a very, very different story, which may not be true. It is a very time consuming thing.

You ought to beware of trying to apply known medical facts to accident victims, and apply it to determining the cause of an accident. I will give you an example. Hypoglycemia is a well known medical condition. Low blood sugar. It can be caused from a number of things. About a month or so ago, I started getting calls from NTSB field offices saying, what do we do to send in samples to you for blood sugar. I said we do not do blood sugar tests because during the agonal stages of death, blood sugar will go up 7 to 10 times normal value, depending on where the sample is taken. Even though a body is dead the chemicals that are in the fluids of our bodies are not dead, and within 6 or 8 hours after death any blood sample that you analyze, would indicate hypoglycemia because metabolism continues in that sample. So you have to be very, very careful in applying this type of thing.

I think the future in this area in determining the behavior of pilots is pretty exciting. There are a lot of new things on the horizon. Capabilities need to be expanded, and the NTSB should embark on trying to get into this area. I would certainly suggest that they send their people to Oklahoma City for a protracted period of time to take advantage of the experience and expertise that has been developed in that area.

Our reports become the property of the NTSB, and all of these services are available to the Board at all times, and many times a timely phone call can save a lot of headaches later on. Thank you.

Gary Babcock
Air Line Pilots Association

Good afternoon. The title of my paper is "The Systems Approach to Human Factors in Accident Investigations."

For several years as a representative of ALPA I participated on accident investigations and observed the NTSB approach to human factors. It has been my experience that the NTSB definition of human factors includes a wide range of topics, not necessarily related to pilot/aircraft interaction prior to the accident.

To review the present NTSB outline in the human factors investigation demonstrates the weakness of the Board's ability to properly address human error issues. Only about one-third of the narrative of this outline is related to flightcrew preaccident behavior. It should be obvious that a group task of two-thirds of its effort aimed at documenting crash fire rescue, cabin evacuation and aircraft kinematics will present one or more human factors data for later systems analysis of the accident causation.

We support the Board's plan to separate survivability from human factors. The requirement to document such a wide range of topics only diffuses the motivation of human factors group members to focus on flighcrew related issues. As a result, important data that may have impacted cockpit operations is not recorded.

For example, very few NTSB reports even mention fatigue. This element is only looked into if there is a comment made on the cockpit voice recorder, or the FAR flight time limit is exceeded. In many accidents where no comment is made, or where no FAR, is violated the crew may have been fatigued. However, minimal information is collected, thus patterns of sleep/wake cycles cannot be analyzed for potential use in factors.

The time has come for the NTSB to review its approach to human factors. The disparity between the Board definition of this subject, and the generally accepted scientific definition can no longer be tolerated. As the Board expands its expertise in human factors, I hope a few basics are kept in mind.

Human factors, or organomics, is defined as the science of applying behavioral principles to systems. The field is interdisciplinary. That is, it represents the inception of a variety of applied sciences having to do with man's structure, functioning and behavior. Those disciplines which contribute to the field include such specialities as anatomy and physiology, anthropometry, kinematics and the annex of body motion, work performance, environmental stresses in sensory and perceptual behavior, learning and training and motivation.

The overall objective of human factors engineering is to prevent human error. A method for accomplishing this is by integrating the human element with the hardware, software, environment and information relative to the system being designed. This can only be practiced within the context of a systems engineering effort.

System engineering is concerned with the analysis of system requirements and the development and integration of system elements for satisfying these requirements, with a limitation imposed by operational, technological and physical constraints. The systems engineering process, or systems approach, results in a series of design tradeoffs by the manufacturer.

One of the more important tradeoff issues within this process involves human factors engineering. The difficult questions analyzed include what role should man play in the system, what does he need to accomplish this role, and how is he to be integrated with the operations, components, information and environment of the system.

You are probably asking what has this to do with accident investigation. The answer can be found in a basic text by McCormick, the information about human abilities and limitations that is useful in the design and development of man/machine systems can be drawn from experience and from research. You depend on research, but also experience.

The value of human factors related accident data is that air transport system reliability can be improved by studying a real world human error sequence which led up to the event. Future aircraft design and current aircraft redesign can then integrate accident experience with related research resulting in increased reliability.

The systems approach technique was employed by the Essex Corporation in a human factors evaluation of the Three-Mile Island accident. This near catastrophe was clearly a case of man/machine system which failed to perform one of its intended functions. Both hardware failure and human error were causative in the accident. Because of the human error involvement complete investigation required evaluation of the system design process and a relationship of the resulting man/machine integration to the accident.

How does Three-Mile Island relate to air carrier accidents? There is a direct relationship, since both nuclear reactor operators and airline pilots are required to perform risk assessment and decision tasks under similar time constraints. I am concerned that current policies and procedures at the NTSB do not reflect the same systems approach in the analysis of human error which occurred in the Three-Mile Island evaluation for NRC.

Again, I want to paraphrase from the report, complete investigation requires evaluation of the system design process and the relationship of the resulting man/machine integration to the accident.

Here is one example of the Board's failure to apply the systems approach to accident investigation. A number of accidents have occurred in the past 20 years as a result of misreading the drum pointer altimeter. Yet the Safety Board has never listed altimetry as the probable cause. If the design of the altimeter is subject to misreading then the Board should recommend replacement of this instrument by an easier to read counter drum pointer altimeter. Merely stating that the pilot should pay more attention to the instrument will not prevent accidents.

Other examples, such as noisy windshield wipers, poor cockpit lighting, difficult to read charts and visual illusions have all had their impact on pilot error related accidents. If the Board does not address the design tradeoff made by manufacturers which resulted in a work environment that continually requires adaption by the pilot, it is only a matter of time before such design indicia tracks the result of another pilot error accident.

In conclusion, I recommend to the NTSB that increased emphasis be placed on the systems approach during the investigation process. I further recommend that a program for increased awareness of this philosophy be developed for all human factors personnel employed by the NTSB.

This year most air carriers will begin flying the latest generation of air transports. It is certainly timely for those of us in the accident investigation community to ensure that our tools provide an adequate feedback to the regulators, designers and operators of these aircraft so the potential for pilot error is minimized. The Air Line Pilots Association stands ready to participate with all other interested parties in this effort. Thank you.

Linda Foran
Association of Flight Attendants

Good afternoon. I have been asked to speak today about how our Air Safety Committee and our Employee Assistance Committees are beginning to work together to help flight attendant victims of aircraft accidents.

First of all, I would like to give you just a little background on our Employee Assistance Program. Several years ago we received a grant from the National Institute of Alcohol Abuse and Alcoholism to start an employee assistance program for flight attendants. This program is a broad brush program dealing with a whole range of behavioral and medical problems.

In this program we get a flight attendant with a personal problem to the appropriate mental health professional. We deal with alcoholism and drug abuse, as well as financial counseling, eating disorders, marital and family type situations and general psychological disorders.

Recently our Air Safety Committee and our Employee Assistance staff have worked together as far as helping flight attendant victims. Our Air Safety Committee will still be our representative onsite, but our Employee Assistance staff will serve as consultants to our Air Safety Committee people.

Last month we had a training session for our EAP staff and we presented some guidelines to use when working with flight attendants immediately following an air disaster. I would like to go over several of these with you.

The first guideline that we talked about was the fact that it is important to help a flight attendant as soon as possible, that intervention at the point of impact can prevent later serious maladaptive behavior. We cited an Ohio State University disaster research unit study that showed that the use of paraprofessionals is highly recommended in a disaster situation. Disaster victims respond very well to peer type counsel. We need to provide this paraprofessional help to wherever the client happened to be.

Our second guideline is that we need to provide information to the flight attendant as she or he requests. Different people have different needs, and a flight attendant may shelter herself from information about the accident, or she may want to hear some of the details.

Thirdly, we need to reassure the victim that he or she has this support and that he or she is ready to express their feelings, that feelings are not right or wrong and that conflicting feelings about the incident are very common. Guilt at having been saved while other people perish, as well as happiness that they came out with minimal injuries or whatever. The peer's function at this point is to help the flight attendant identify and express these feelings, because healing does come about by verbalizing feelings.

Finally, our flight attendants have been trained to help a flight attendant victim plan for the immediate future, such issues as hospitalization, insurance coverage, securing personal belongings, sending for a suitcase, identifing or calling and informing relatives, family, friends, that kind of thing, and securing professional help, should that become necessary.

Later on down the road our Employee Assistance staff would get involved should long term therapy be necessary. Our Employee Assistance people have their own guidelines requirements for mental health professionals.

Finally, in conclusions, I would like to say that although we may seem to isolate our flight attendants directly following an aircraft accident it is not our intention to prohibit interviews in any way. We feel that as a union we have an obligation to protect flight attendants against long term maladaptive behavior. Thank you.

Delmar M. Fadden
Boeing Commercial Airplane Company

Good afternoon. We at Boeing are delighted to have this opportunity to address the Board and staff. While there is a general belief that human performance investigation can be of benefit in understanding factors pointing to an air accident, there is little proven methodology for such investigation. As has been the case with human engineering in aircraft design it is necessary to develop the application methodology in parallel with other investigation efforts.

Our experience in applying human engineering design indicates that a significantly different methodological approach must be used than is typical in more traditional engineering disciplines. In particular, the rigorous and systematic pursuit of all possible causes for a particular element of human performance is essential. Furthermore, in the step from understanding one event to recommendations suitable for most events is a far more difficult and complex one in the area of human performance than in most other areas.

We have found that most human engineering problems are effectively dealt with using a systematic analysis of all relevant factors in the crew, airplane and environment system. Initially, the process is straightforward. However, where it becomes difficult to maintain once hardware limitations or design constraints become known. The intentional isolation of human engineering function only makes the situation worse by eliminating the sources of interdisciplinary interaction which we found essential in conducting a complete analysis.

As aircraft have become less physically demanding on the flightcrew the importance of various flight management tasks has risen. These tasks extend the range of possible factors influencing the crew at a given time. Unfortunately, the tools available to assess the relative effects of multiple influences upon the crew are very limited. This usually means that it is not possible to pin down a unique cause and effect relationship. Often the best that can be done is to list the possible influencing factors along with subjective comments as to their possible significance.

While some may view this type of output as vague we find such lists to be the nucleus in evaluation studies and new design ideas which do indeed solve the problem. While our approach may have limited applicability to accident investigations there are many parallels. After all, the ultimate goal is the same. From our point of view, the key contribution in the human performance group in any accident investigation will be the systematic development of a listing of the possible cause factors which did or could have influenced the flightcrews to the point of error. The mark of quality will be the rigor with which that data was gathered and analyzed.

The methodology outlined by Dr. Stoklosa in a 1981 article on human performance factors in aviation accidents, the investigators methodology, presents a good start toward developing the necessary systematic approach. The list of factors included in the investigation model is broad, although additional operational factors must be explored in most accident situations. A multidiscipline approach to operational factors is a method we have found to be consistently effective in identifying problems and solutions. Two person teams of preferably a research psychologist and an engineer with pilot background provide the necessary synergisms without requiring excessive procedural overhead. By

whatever method, we recommend that continued refinement of the investigative methodologies should be the chief objective of the human performance group at the present time.

The process of generating recommendations once the causal and contributing factors have been determined introduces many new considerations. When human performance factors are indicated development of meaningful recommendations becomes even more complex. The fundamental issue is one of generalizing from the factors involved in this specific accident to recommendations which will improve the safety in aviation as a whole, considering the full range of pilots, controllers and equipment.

In many cases, human performance factors cannot be identified with certainty. Even when a particular scenario can be selected as having the highest likelihood, the other scenarios cannot be ruled out. In these cases, developing an appropriate recommendation may require more time and effort than the accident investigation itself.

The following example taken from the Boeing 757/767 design illustrates the point. The rules and guidelines which establish the basis for most warnings on current commercial transports stem largely from the accident and incident experience of the past. Individually, the need stipulated for bringing each warning position to the attention of the crew is consistent with good human engineering principles. However, taken together, the oral identification requirements in complying by these rules and guidelines places demands on the pilot which would exceed human limitations.

In some aircraft the pilot is expected to correctly relate 17 or more distinct warning sounds for the particular flight or equipment condition. Human factors research indicates that human beings can perform this type of task more ably if the number of distinct sound condition is kept low.

The function of warning research sponsored by FAA, and conducted currently by Boeing, Douglas and Lockheed, provide a strong support for a more systematic approach to crew alerting. This work was begun was in the early '70s and it has progressed through several stages to the present time. By the late '70s, when the 757/767 design effort as at its peak, enough information had been collected to enable FAA to write a position paper on crew alerting. While the position paper did not change the existing rules governing warning, it did provide a means for demonstrating equivalent safety. The 757/767 crew alerting system uses a limited number of sounds to attract the attention of the crew and to establish the urgency level of the alert. A visual display on the main instrument panel is used to identify the specific alert condition.

The process of establishing the acceptability of an alternative to previous warning systems practice was lengthy and complex. Moreover, the process itself revealed information about the man/machine relationship that significantly altered initial assumptions.

A similar situation exists with respect to the CRT flying instruments on the newer aircraft. The development process for the human factors basis in the design of these instruments has required more than 15 years and has involved hundreds of people working in many different organizations.

The goal of any human factors program must be to make the interface between machines and the people who operate or use them safe and as efficient as possible. The

emphasis here is on people, not a single person. Each of us involved in the process has a very limited understanding of all possible operators' viewpoints and working strategy. Yet the man/machine system must accommodate the diverse styles of thinking which characterize the range of operators.

While the present method of developing solutions to the human factors problems is not fast, it is the surest way of ensuring that solutions are effective across the broadest spectrum of people. With these points in mind one can conclude that the primary thrust of human performance efforts should be directed toward thorough and complete investigation and reporting, particularly in those instances where a clear cause and effect relationship cannot be positively established. Recommendations should then be aimed at starting the process of finding a solution.

From our point of view, the clearest possible statement of the events surrounding the accident itself and comprehensive examination of all possible contributing human performance factors is the initial critical step necessary to bring about positive change. Thank you.

George I. Whitehead, Jr.
Piper Aircraft Company

Good afternoon. Mr. Moderator, members of the panel, ladies and gentlemen, there is a lot of deja vu in here for many of us who have been around awhile, and perhaps what a law school professor said to his students may have some application for both industry and the government. It is only by constant iteration that you can convey the foreign thought upon the reluctant mind. But I was planning to wing this afternoon, but I got a command to prepare a paper, and being a good soldier I obeyed and prepared a paper.

There are no unsafe characteristics in a) a properly certificated airplane, b) manufactured to conformity specifications, c) maintained to FAA and manufacturers inspection standards, d) flown by a pilot qualified for the flight involved, and e) operated within its limitations envelope. Man and machine really perform as intended. Deviations from one of the above or in combination cause accidents. "Act of God" or if you prefer French, "force majeure" is an exception. Thunderstorms, tornados, icing, and wind shear are examples; however, natural phenomena may not be the sole proximate cause. Human intervention may have combined to bring the airplane down. There can be more than one efficient cause of an accident.

Finding the deviation(s) is the work of accident investigators. It is important, too, for the investigator to eliminate probable causes and document that he has done so and why. Perhaps too much emphasis is placed on the probable cause call to the exclusion of making sure what did not happen.

Human factors, the man-machine interface, is my assigned subject. So, in the limited space and time available let me suggest the nature of some of the problems.

Flying is not easy. Safe flight requires skill and judgment. Wind and weather, especially, make it so. The results of accident analysis has been signaling for a long time that an alarming number of the pilot population do not have the skill and judgment needed to use an airplane as a personal cross-country vehicle. The chances taken at sucker odds suggest that the pilots had no appreciation of the risk involved, but the flights were missions impossible from the beginning. A private pilot making a business or pleasure cross-country trip has the great responsibility of being his own planner and dispatcher. He makes the "go-no go" decision - no flight operations staff to share the call. And once the "go" decision is made there will be no State troopers patrolling the skies, and issuing tickets to deter law breakers, no clouds to park on, and no tow trucks to bring home those who made wrong decisions. It is sad, indeed, that all too frequently bad decisions are being made. It is sad, too, that accident causes have been perceived accurately enough for years, but many of the accident problems that beset us continue to be intractable.

There are those who say that not very much can be done to improve the skills and judgment of personal pleasure and business pilots. Recurrent training is voluntary, and "normal carelessness" has to be accepted as "ordinary frailities of mankind." The way to go, they say, is engineering a "normal carelessness" proof airplane. Human factors engineering research is important, but for those who have to deal with harsh realities "normal carelessness" in an airplane is unacceptable. Until the pilot is engineered out of the cockpit and someway is determined to save him from poor judgment calls - launched like the space shuttle - what to do about human intervention must have a high priority for those studying accidents and their prevention.

In this connection there is a need to place greater emphasis on investigation into the family, social and business environment of the pilots of accident airplanes. What are your chances with the "see and been seen" concept when fate puts you on a collision course or in a holding pattern with a distraught pilot who must cope with teenage children at home and an alcoholic wife.

Briefly, some of the conflicts between top proficiency and the design of a "normal carelessness" proof airplane may be illustrated by the following two examples:

1. When the Tomahawk, PA38-112 was approved by the Royal Air Force for training air force cadets, the UK instructor pilots found the airplane to be clearly an improvement over many current light airplanes in the area of stalling and spinning characteristics, exhibiting classic stall symptoms.

   The FAA is now considering AD action to require the installation of two additional stall strips, modifying the classic stall symptoms preferred by the RAF instructor pilots, to prevent inadvertent spins, which they will not.

   Top proficiency v. "normal carelessness" - should owners and operators have the choice in a trainer?

   Most of the stall/spin accidents in the early days of the PA30, Twin Comanche, could probably have been prevented by transition training. Do not practice single engine stalls at 2,000 feet, and do not get below Vmc on single engine go arounds etc., basic stuff, but the multiengine instructors and students in accident airplanes were absymally ignorant of those admonitions.

   A kit that included flow strips to be installed on PA30's was never made mandatory by an AD, but most owners voluntarily accepted the kit as a product refinement.

2. A low thrust detector system, STC'd, will provide visual identification of the engine that is losing or has lost power, possibly preventing "normal carelessness" and feathering the wrong engine.

   The top proficient pilot hones his skill and judgment in engineout procedures from identification to shut down to landing.

Nothing should diminish the sharpening of basic emergency skills. Manufacturers study accident reconstruction files - in house, NTSB and FAA - for information that will expose problems, especially generic in nature, which can be identified and corrected. In human factors engineering there is a need to know from field accident investigators things such as the following: improper use of or failure to use controls; misreading instruments; adequacy and clarity of information available to the pilot in airplane flight manuals; mismanagement of fuel systems; and operational errors. Piper provides its investigators with a check list, 25 pages, containing major sections that include STRUCTURES, AIRCRAFT SYSTEMS AND INSTRUMENTS and CRASH PROTECTION AND HUMAN FACTORS in which a wide range of information is asked for. Under PILOT the investigator is reminded that he is required to develop information relating to health, drugs, alcohol, stress-business-family-rest, and reputation among his peers as a pilot. The check list is designed to help them do the job which is to determine what happened and what caused it to happen.

Accident information files are circulated among engineering people for evaluation and to make the what-to-do-about-it decision. Upon request Piper will provide the NTSB or FAA investigator-in-charge with a copy of the Piper investigation. At least from our side of the fence the relationship between Piper field accident investigators and NTSB and FAA people has been excellent.

Finally, in the market place where practical decisions are being made every day to keep things moving along, the designer of a typical single engine general aviation airplane must design within certain limitations, one of which is space. The envelope is 54 to 51 inches from the pilot's left elbow to the right elbow of the right front seat occupant and 48 inches more or less from the seat to the top of the fuselage. The designer's challenge is to fit two people into a space that is reasonably comfortable and attractive. The location of instruments and flight controls must be well planned for maximum visibility and accessibility, easing the pilot's workload and eliminating areas where the design might induce pilot error. Seats must be comfortable and provide attenuation as limited by the space envelope. Appropriate crash protection includes restraint systems, and a straight forward means of egress to minimally compromise the fuselage structure. Designing the optimum environment for passengers and crew is an on going program, the complexity and importance of which is clearly understood by manufacturers.

Accidents, fortunately, are not the only source from which human factors engineering is stimulated. The great number of its own people who fly Piper airplanes, especially in service test programs, are critical evaluators of the product, and service experience transmitted through customer services channels provides early on notice of problems and their trends. Field representatives, sales, service, and product support specialists, are the antennae of the manufacturers for complaints directed against the product.

The harsh truth is that not every problem is soluble. Nevertheless, problems must be exposed and solutions offered. We at Piper are pleased to have the opportunity to participate in this symposium which is designed to do just that.

Dr. Andrew Horne
Federal Aviation Administration

Good afternoon, ladies and gentlemen. The topic of our presentation will be biomedical and behavioral factors of the pilots in aircraft accidents. I will start by saying that the National Transportation Safety Board has determined that the pilot is a cause factor in about 80 percent of aircraft accidents. If an indepth investigation of the human factor element and other causes was performed, the results would probably indicate that the human is a cause factor in over 90 percent of aircraft accidents.

I will not address the biomedical and behavioral factors related to other than pilot factor accidents, except to say that program for discussion, the factors that may affect pilot performance also may affect the performance of other personnel in the aviation industry. Performance degradation in pilots can be considered pilot incapacitation.

This incapacitation can vary from total loss of ability to control the aircraft to partial loss of control. Even minor performance decrement can be critical in accident causation in the aviation environment. Preexisting disease is the first of several factors that can result in pilot incapacitation. Incapacitation may have rapid onset with dramatic results, but be very difficult to prove as the cause of an accident when there are no survivors.

Conditions such heart attacks, seizures or strokes can result in sudden incapacitation, and preexisting disease causing the event could not be detected on the pilot's physical examination required for medical certification. Postmortem examination may show evidence of the disease process but not be conclusive in determining if a disease caused incapacitation. Preexisting disease may not be apparent because of body condition. However, it can be discovered with thorough investigation of past medical records, and through medical history.

The NTSB does not often undertake this sort of investigation, being content to review the FAA airman medical examinations and the autopsy report. In a recent major air disaster the captain's airline medical records reviewed by the FAA during the investigation indicated the probability of liver dysfunction. The NTSB failed to pursue this evidence, even after recommendation by FAA investigators to do so.

Sudden total incapacitation of airline pilots at the controls of an aircraft is not as rare as one may think, but without a major air disaster receive little attention from the NTSB, whose prime mission to promote safety through the investigation of incidents as well as accidents.

Perhaps the best investigated of the pilot medical and behavioral factors contributing to pilot incapacitation are those in the area of toxins. The FAA currently receives specimens from about 65 percent of the pilots killed in aircraft accidents, and provides the results of toxicologic examination to the NTSB. This examination of tissue specimens often results in conclusive evidence, particularly as applied to alcohol and carbon monoxide. Other findings should result in a broader investigation of medical factors, but this seldom happens.

Your heard Dr. Lacefield from the Civil Aeromedical Institute, so I will not dwell on this area, except to mention the difficulty involved when crewmembers survive the

accident. Several industry groups represented at this meeting opposed an FAA Notice of Proposed Rulemaking that would make toxicologic evidence from surviving crewmembers available to investigators. I find this unique, and in conflict with those groups' safety endeavors.

Since this panel is supposed to be a critique of NTSB human performance investigation, I feel I must relate an incident during an aircraft accident investigation that involved toxic factors in a pilot who survived the accident. His hospital records were subpoenaed and indicated that he had been up most of the night and had consumed a couple of beers just prior to the morning flight. At the request of a labor group the NTSB Board Member in charge of the public hearing did not permit that evidence to be pursued because of its sensitivity, nor did the information appear in the Blue Cover.

A third area of factors related to the degradation of human performance are those that result in physiological incapacitation. Among these is spatial disorientation, which is one of the more common NTSB probable causes of fatal general aviation accidents. Usually the use of spatial disorientation as probable cause in an accident is presumptive on the part of the analyst, because most are fatal. An even more nebulous factor in this category is exposure to the hyperbaric environment of high altitude flight. There is no certain way of determining if hypoxia or decompression sickness was a factor in an accident by postmortem examination.

Without survivors, one must consider the cabin altitude of the aircraft and the oxygen system available. Again, in critiquing the NTSB methods of operation, it is of interest to note that a crewmember fatality related to the misoperation of a galley elevator was glamorized by a Blue Cover report while a recent crewmember fatality as a result of decompression sickness was all but ignored by the NTSB.

While both of these accidents were unusual, the potential of decompression of pressurized aircraft is such that an accident related to this cause deserves study by the NTSB in its ongoing quest for Safety Recommendations.

The fourth, and final broad category associated with human performance contains all those factors that must be considered under human behavior, or the so-called psychological factors. It is this area in aircraft accident investigation that the public is most critical, but it is also the area most difficult to quantify.

I am sure the panelists will discuss the mystique of psychological factors in depth. I will terminate my presentation by saying that the investigation of these factors as a cause of performance degradation is interesting, but not as rewarding as many suggest. Much of the investigation is blocked by so-called interested parties, and evidence obtained is not used in the formulation of probable cause because of its sensitivity.

Even before the concept of the NTSB human performance group, significant evidence has been obtained in the area of of behavioral factors but not used because of its nonquantifiable nature. The probable cause of a catastrophic accident several years ago was recently changed after petition by a pilots' labor group exonerating the flight crewmembers. It is doubtful that the factual evidence available in the docket but not mentioned in the Blue Cover was considered by the Board when this petition was granted. Evidence was obtained during this investigation that would support pilot performance degradation on this particular flight, but was not used because of difficulty associated with its significance and with its sensitivity.

In closing, I will predict that no matter how many human performance specialists the NTSB hires the use of behavioral factor evidence gathered in aircraft accident investigation for the determination of probable cause will be infrequent, because of party influence, the subjective nature of the information, and Privacy Act ramifications in the case of surviving crewmembers. Thank you.

Captain Richard Stone
Air Line Pilots Association

I would like to thank the Board for this opportunity to participate as I did in Downingtown, which I think we learned a lot by, and I hope we learn a lot here, through tomorrow.

The first accident investigation I participated in was in October, 1968, and it was for a Northeast Airlines, a Fairchild which ran into a mountain, or a small hill, in Lebanon, New Hampshire. Since that accident I have worked primarily in the area of human factors and human performance and can recall all six specialists that Board assigned in this area. It started with three doctors, and more recently, three psychologists. The doctors were preoccupied with the hospital routine of autopsies, hospital care and the recovery of medical evidence. The psychologists have been preoccupied with interview techniques, self-perception and learning to fly. Thus far, two accidents have seen the formation of the human performance group. In the Cascade Airway accident in Spokane, 1981, and the Air Florida in 1982. In the case of the Cascade accident I recommend that you read the human performance group report. The group reported the pilot-in-command was depressed, and based this conclusion on witness statements. The witnesses were all layman, yet their diagnosis of a specific disorder was accepted. The diagnosis of personality disorders is the domain of the psychiatrist or the clinical psychologist, not experimental psychologist.

The Air Florida accident saw the formation of the human performance group for the second time. I was a part of that group, and was very dissatisfied with the factual representation. Being at odds with the group leader put me further outside the technical review and the normally informal analytical process that goes on.

Let me just cite a few examples of the problems encountered in this group during the field phase. An observer to our group who called himself a psychologist but who had no professional training or certification was allowed to conduct sensitive crew interviews. In addition, the group chairman, who agreed to be accompanied by an Air Florida pilot during the interviews, decided to forego this formality and engaged in a subsequent loud and heated exchange with an Air Florida captain in the crew lounge.

The problem in the way the Board is conducting its business in the area of human performance is that it has been sold a bill of goods by the psychologists. Most of the effort is being directed toward the psychological autopsy. This is an attempt to dissect each portion of the individual's psyche, looking for evidence of disease. Unfortunately, this is a very imprecise tool, the psychological autopsy. It easily leads to improper conclusions and tends to excite the vicarious. Before this type of investigative procedure is used there should be clear evidence of a pathological disorder. A more balanced type of investigation is certainly in order.

In the case where no pathology is evidenced, interviews with pilots, peers, and family members should be confined to nutrition, rest and general demeanor. What value can be gained from talking to the pilot's banker or the clergyman, as was seen as a part of the plan in the Air Florida accident investigation?

The difficulty here, in talking to these kinds of people, is one of happening onto a person who may have a personal axe to grind against the pilot that has nothing to do with

the accident. The psychological autopsy seems to be the major emphasis in human performance at the present. It is seriously taking time away from the important work of this group, and that is in understanding the operational constraints and realities, reviewing the relationship between crew and aircraft, and describing the real time decision alternatives.

In this business of accident investigation I believe we have to be very careful in allowing specialists with advanced degrees to direct the course of analysis of the investigation. Who will judge their qualifications? Who can judge their personal bias? Who can tell when they are outside of the field of their expertise?

It is important to use specialists in roles where their knowledge can be applied to specific information. The task of investigation belongs to the investigator who is a generalist. Specialization within the investigative process such as ATC or structures is certainly appropriate. It has always been my experience that the best accident investigators are cognizant of the whole investigative process.

Unfortunately, the perception of the value of the human performance groups has been low among experienced investigators. Typical of this was the way we were allowed to review the cockpit voice recorder in the Air Florida investigation. This consisted of having access to a very poor quality recording of the CVR and listening to it on a portable recorder in a conference room. Operational knowledge and experience are critical to the generalist accident investigator. To go the other way and attempt to impart operational knowledge to the person with an advanced degree is not only a waste of time, but is a poor use of resources.

The type of analysis that should be available to the Board is well represented in the April issue of Aviation Accident Investigator, for those of you who subscribes to that new little paper. Dr. Richard Jenson, Director of the Aviation Psych Lab at Ohio State reviewed the Air Florida accident from the aspect of the human frailties involved. He briefly discusses training and experience as well as the group dynamics and social setting present. Dr. Jenson provides an interesting discussion of the role reversal when the first officer is flying. Finally, he states a need for interactive training which goes beyond the usual assertiveness training. The present track of the Board on human performance is troublesome indeed. A new data collection system has been instituted. New personnel are being hired. The Board is talking about new efforts to get at the cause of pilot error.

However, the one critical element that appears to be missing is the scientifically credible in coherent design. Thank you.

Dr. John K. Lauber
National Aeronautics and Space Administration

Good afternoon. Before I get started in my presentation I would like to respond to an earlier question which was raised a little bit ago. We do have a major program underway at NASA Ames looking at the issue of pilot fatigue and circadian dysrhythmia and related kinds of things, and trying specifically, among other things, to understand what it is that enables some people to do the job correctly and to learn from that educational training material other kinds of things that could be applied by individual line pilots in the course of doing their job. So that program is very much underway. If you want to hear more about it I would be happy to discuss the program with you at some point.

I am not going to repeat the numbers regarding the proportions of human error involvement in accidents, because if you do not remember what they are by now there is no hope for you. But I am always reminded when I hear those numbers of a statement that was made several years ago by Scotty Crossfield when he was with a Congressional delegation out at Ames. We were briefing him on some of the human error research that we were doing. I made a comment along those lines, using those same numbers, and Scotty jumped and said, "well, hell, it's all human error accidents. We either design them wrong, we build them wrong or we use them wrong." So in that sense I think he is quite right, that human error accounts for 100 percent. What we, of course, are concerned with in the human performance issue is that last part, using them wrong.

What I did in preparation for today's session was to go back and take a look at the historical record just to see what could be learned, and what lessons were in there with regard to the task before us at this meeting, and it was kind of interesting. I found some fascinating things. I have available a series of accident reports that date back to 1939. There were some fascinating things in there.

In fact, I want to paraphrase and then quote directly from one of those, because I think it helps illustrate a lot of the points that have already been made in many ways by other people at this conference in which I would like, in my presentation, to underscore and emphasize the importance thereof.

On June 10, 1941, a United Airlines DC-3-A overran the 7,000 foot north/south runway at Municipal Airport, Denver, Colorado. It was night, and the winds were reported initially as calm and then later north-northeast 5 to 10 miles an hour. Visibility as observed by the crew is over 5 miles in all directions, and moderate rain was falling.

The tower reported that the entire north/south runway was available and that flare pots marked its intersection with the northeast/southwest runway - some interesting lighting technology available for this accident. Captain Jeppeson - and it is the Captain Jeppeson - stated that his approach was planned to contact the runway north of the flare-marked intersection and thus to avoid possible collision with equipment which a flare might have marked but was extinguished by rain. Just before touchdown a gusty wind was encountered and rain reduced the visibility through the windshield to zero.

Captain Jeppeson applied partial power and continued flight at 85 miles per hour until restored visibility enabled him to complete the landing. To make a short story even shorter, the airplane, still moving at 20 to 25 miles per hour, continued north through the boundary lights, across a 3-foot ditch where the right main landing gear failed to a point 221 feet north of the boundary lights.

Now, already I think you have picked up some interesting contrasts with the present day reports, just in terms of approach speeds, flare pots, and that sort of thing, but I think the most interesting aspect of this report is still to come. Incidentally, here is another lesson. The entire report is one and one-half pages long and was dated 19 days after the date of the accident. I want to quote directly the final paragraph of this report, including the statement of probable cause.

"Investigation disclosed that no mechanical defect existed in the braking system. Although the tires were found to be worn, their condition did not show any localized abrasion such as would be expected to result from skidding. Captain Jeppeson, with more than 10,000 hours of flying, has an exceptional record for reliability and sound judgment. It was his opinion that with normal braking effects there was adequate room to stop. Probable cause, ineffective brake action."

You know, the interesting thing about this report and many others dating from that era, in fact, all the way up through into fairly recent times, they all contain some fairly common characteristics. In this report there was no mention of things like visual illusions, there was no mention of anything like crew coordination, communication, cockpit resource management and all of those buzz words that we are throwing around nowadays. In fact, there is no mention that there was even a copilot in the airplane.

I think it does help to illustrate the fact that in some ways, at least, we have come a long way. But the one thing that is in here is a statement of probable cause, and I do not know, there may be people out there who know how far back the concept of probable cause extends. I do not, but it is interesting that it is there, and I think that is one of the major points that I want to underscore. It came up earlier today several times, and I am sure it came up yesterday as well, and I think it is a fundamental problem with the probable cause concept. In fact, I think that the significance of the problem is even more fundamental than - as far as inhibiting effective investigation of human error in accident investigation - the lack of availability of suitable techniques for doing so. I think we do have some good ways for investigating human performance and the contribution to human error in accidents, and I think this necessity to look into the probable cause thing was probably inhibited that effort more than any lack of suitable technology.

One of the things that is wrong with the probable cause concept is that it tends to focus on individual performance, and it tends to be cast in a fault-finding mode. There has to be an assignment of blame, or an assignment of responsibility, or whatever you want to call it. But the concept really tends to over-simplify what is usually an extremely complex interrelated chain of events that result in an accident. It is unfortunate that the statements really never say very much, or are very illuminating with regard to the whole question of why an accident occurred. However, they are clearly models of clarity when it comes to the whole question of whodunnit, and I think that is one of the principal things that struck me in the course of going through these accident reports.

I am skipping over a lot of information here in the interest of time, and in the written version of my paper, in fact, I quote several articles and studies that illustrate other problems having to do with the probable cause concept. I realize that this is something that is not immediately subject to recommendation through our own actions, and that legislative pressure is required. I found it ironic in John Yodice's comments this morning that the only thing that is protected from use in litigation is the thing that as far as I am concerned is probably the worst offender of all. I do find that ironic. I would urge that whatever can be done to change the situation and to get away from the notion that

there is a probable cause or probable causes to an accident be done. This must be done to get us out of the adversarial situation that we so often find ourselves in pursuing human error in accidents, and this kind would be a great step forward. In fact, it would be greater, I think, than anything else we could do as far as human performance or psychology or other techniques that can be developed by the scientist.

There are two other areas that I want to mention as being areas of concern and something that I think we can offer constructive advice to the Board with regard to. One of them is the issue of team performance. I think a lot of you who are familiar with the human performance research that we have underway at Ames recognize that one of the major areas that we are doing some work in is the very area of the team performance, as opposed to individual performance.

There are literally thousands of studies that show that the performance of the team is not the simple sum of the performances of the individuals who comprise that team. There are true interactive effects, and in order to understand the dynamics of a crew, or if you want to extend the concept of the team, you must include the pilot, the controller, and other people in the system. In order to understand those relationships and the impact on the sequence of events which led to an accident we have to consider aspects of team performance.

People in our lab, for example, have done some work with ways of analyzing cockpit voice recorder data. They have looked at a communications or a linguistic oriented analysis, and have related that, for example, to errors as we saw it in the Russell Smith study. We have some other work underway out there which also takes a linguistic approach to addressing some of these issues. So that is one area that we would like to try to develop some specific recommendations and urge that we continue to move forward with regard to addressing questions of team performance as opposed to individual performance.

The final area that I want to mention, and again, this is something that I am typically going to underscore. You know, it is difficult after being by count the 49th speaker on the program to be brilliantly original, so I am not claiming originality here. However, I can help to underscore the importance of some of these things. This is the whole issue of the glass cockpit, new technology in automation, and the question of whether or not we are moving rapidly enough or developing adequate techniques for investigating the accidents which I am afraid we will probably be seeing with those airplanes as we have with everything else.

Because of the many modes available in displays and in the performance management computer systems, the flight management systems, and the autopilots, and the interpretation of what you hear on the cockpit voice recorder, it is going to be a very difficult task. I would urge that you give some special attention to this whole question of technology, and how to anticipate doing an adequate and thorough job of understanding exactly who was doing what to whom and when the cockpit, and how that all related to the automation and the technology on board that airplane in anticipation of being able to do an adequate of human performance investigation.

Let me just close by making a brief reference to a 1974 paper that Les Kowalski, Dick Masters, Dick Stone, and Gary Babcock wrote, having to do with an analysis of pilot error related aircraft accidents. In that paper some of the things that they concluded were that we need a more systematic collection of human factors data at the accident

site, that we need more information to reconstruct what transpired in the cockpit prior to the accident, more reliability of information by reassessing pertinent rules and principles of legal liability and four, development of an onsite system to allow quick determination of the likelihood that a given accident has a problem with human factors aspect.

I think we can all agree that there has been progress made in some of these areas, but clearly, we have a long way to go before meeting each of those worthy goals, and I think one of the major tasks that we have as working groups tomorrow is to attempt to come up with meaningful and constructive recommendations that the Board can apply in the course of pursuing those objectives. Thank you.

Captain Rod Gilstrap
United Airlines

Good afternoon. I want to thank the Board, Board Members and the assembled group for the opportunity to be here and to comment on some of these things. You know, we can object to aviation safety in this nation and the NTSB specifically, but the function of the Board is a little bit like democracy itself. It is ineffective, it is slow, does not do exactly what we would like it to do, but it is better than anything else that we have ever designed, and I think the National Transportation Safety Board does a better job than any other organization in this world in terms of safety.

Sure, we have our problems, and since I have spent a fair portion of time down on Massachusetts Avenue, I am one of the major hand grenade throwers. I guess if I have anything to complain about is the working conditions here today, and I think we ought to talk to the ALPA about duty rigs and time on duty and that sort of thing.

I got involved in the first accident investigation in 1954 in the Marine Corps, and I think if you would go back and check that investigation it was probably the poorest one ever done in the military service. It was terrible. We screwed it up so bad that when we got done we could not even tell who was in the cockpit.

I would like to stand here today and tell you that what I am going to say - and I did write a speech, but I would not read it to you for a million dollars; well, for five dollars - and I would like to say something that would go down in history. I think I can prove to you in a couple of minutes that I am a better pilot than a historian.

You know that Nathan Hale something like that he only had one life that he could give for his country. I think it was Admiral Farragut that said damn the torpedos, full speed ahead, and you remember General George Custer at the Battle of Little Big Horn when he looked up over that rock and said, "For hell's sakes, where did all the Indians come from."

We have a lot to say here, and I think human performance is important to us; it is very important. I think the future activity in terms of accident investigations are going to be in the human performance area. How we are going to do that, and how we get there is tough. We have been at it for a long time. We worked on it, I think, intently for about 10 years now, and I am not so sure that we are doing it a lot better now than we did then. Maybe some.

But maybe there are a few things we can do. First, I am fully convinced, and I say this as an individual who taught psychology at the university level, that if we have to make a tradeoff in terms of our human performance investigators in aircraft accidents, I am going to choose an experienced aviation person and make a compromise in terms of psychological training and experience rather than the reverse.

I have seen more errors made by highly educated human factor specialists without an adequate aviation background than I have seen the other way around. I think that I have heard it suggested here that the way we do this is to pair two people. We take an experienced aviator, an experienced aeronautical person - and I do not think it has to be an airline pilot, and I do not think it has to be somebody that flew yesterday to understand

the system - but there is a terminology, a technology that goes through this very sophisticated aviation system, and if you do not understand the system you are not going to be able to understand how to analyze the humans that behave in that system.

I think that I would certainly choose for this heavy, heavy aeronautical background, and I think the Board has tended to do that, and I would like to see that in the future. I think that there is a scientifically developed protocol for these studies, and if such a protocol is published, and I know that we have participated in the development of them through the years, but if we can develop that protocol for human performance investigation and analysis, I think we would be well ahead.

Tied with that analysis we have to solve this problem of how we use cockpit voice recorders. I do not believe that it was the intent of the people who promoted the new law, nor Congress who passed the law, that the contents of the cockpit voice recorder should be kept from the investigators for 60 days. But that is exactly what is going on now, and that is a major error. I realize it is a Board decision, but I that decision ought to be reconsidered today. We can afford to give away that tool, to have people out working in accidents and have the only knowledge that the people working in the field have for 60 days because that information gets bootlegged and slipped out of the cockpit voice recorder. We cannot live with that. We can live for any time in the future at all. That, very frankly, is the way it has been done, and I have a major problem with that, and I think that is a correctable problem. I do not think that was what the law was intended to do, and I think it ought to be taken care of soon.

I am not happy with the whole concept of the psychological autopsy. The word itself starts us down the wrong track. Is a correctable thing, although I really have not seen it abused, personally. In fact, my own personal experience with the NTSB people who have been involved in the psychological autopsy program handled it quite maturely and with consideration, but it certainly is a concept that has got some potential abuses.

The other thing that we can do, and we can do it right now, and we are asking too much maybe of accident investigation, but the question came up earlier in the day, we have the opportunity through loss scenarios and through training to reinforce positive actions of crewmembers in airplanes at times of stress, conflict, incidents, near accidents. We can load a crew in a simulator - and we do - to the point that 50 percent of the crewmembers will not complete the mission without a crash.

In other words, we know that we can put pressure on a crew to any limit that we want until they can physically and mentally not handle the problem. But when we do that, and we can do that as a training device, not in terms of checking, not in terms of proficiency, not after the accident, but as a training device. We can see behavior take place, and we can study that behavior, and we can see how people make errors and we can see what errors they make.

We here in this industry now, we have had loss scenarios going on for years. We have simulator instructors and training instructors out there that have a world of experience about how pilots behave under certain circumstances, and we are not using this data. I think the lessons are there, and we can learn from those lessons in terms of human behavior and human analysis what we ought to be doing.

Now, we have said for years that incidents in many cases are nothing more than accidents, but they were handled properly, or that we had good luck with them, or that

the proper decisions were there, or there was synergism taking place, or there was an interacting crew. Something took place in those incidents that made it work out good.

We can study those. We can study them at length, and this industry can move itself along quite a bit on that, and with that proposal for you I will tell you that there are problems of communication that are greater than just going around curves and hitting 500-pound pigs.

We had a situation in San Francisco in 1981 where one of our mechanics out there modified his recreational vehicle to a propane system, and when he got done putting this propane tank and propane system into his camper he had a gas tank left over. So he used that as the holding tanks for the toilets. He came out of his house one morning and he found a siphon hose coming out of his gas tank, and a very disgusting mess on the lawn where somebody had been very sick. You can get yourself into trouble sometimes by not understanding theory of the situation besides just communication. Thank you.

SECTION III

RECOMMENDATIONS AND RESPONSES

RECOMMENDATIONS SUBMITTED BY THE MAJOR AIR CARRIER INVESTIGATIONS WORKING GROUP

1. Recommendation.--Amend Section 845.13 para (b) (and presumably, section 831.9(c)) as follows:

> "No party shall be represented by any person, who also represents or will represent claimants or insurers in that accident investigation."

Response.--Section 845.13(b) and section 831.9(b) provide that no party to a field investigation or a public hearing "shall be represented by any person who also represents claimants or insurers." The Board's emphasis in applying these provisions generally has been on the representative's affiliation at the time he or she participates in the investigation or hearing. However, there have been difficulties involving persons participating in an investigation as a party representative, but then asserting the attorney-client privilege in civil litigation. This claim shielded the person from discovery. As a result, the Board has developed and is now using a procedure which would prospectively affect the role played by party representatives in the ensuing litigation. (See appendix A.) Under this procedure, party representatives are required to sign a statement affirming that they do not represent claimants or insurers and that their purpose is to assist the Board rather than to gather information for litigation. This precludes a party representative from subsequently asserting the attorney-client privilege during the civil litigation and thus shielding himself from discovery. However, if a pattern were to emerge wherein persons who participate in our investigation subsequently asserted the attorney-client privilege in litigation (by claiming that they was gathering information, during the Board's investigation, for purposes of litigation), the Board could take appropriate action, such as barring the persons from participating in future investigations.

In view of the foregoing, the Board believes it is not necessary to revise the wording of either sections 831.9(b) or 845.13(b). (See Recommendation 67.)

2. Recommendation.--Interface activities in an investigation with the FAA to be certain that in the exercise of the respective statutory responsibilities there is no impediment to the accident investigation process.

Response.--The Safety Board and the FAA recognize that problems can arise from the FAA's conducting an enforcement investigation simultaneously with its participation in an accident investigation. The Board makes a concerted effort to keep investigations separate so as to avoid the intimidation of persons who could contribute valuable information to an accident investigation. The Board investigator-in-charge (IIC) is instructed to take firm and immediate action to deter an FAA investigator from in any way impeding the conduct of the accident investigation. Additionally, Board staff discusses periodically with the FAA staff the guidance to FAA investigators on the relationship of their activities to NTSB investigations. The Board's policy that FAA activity must in no way impede accident investigations is reiterated during these discussions.

3. Recommendation.--Reiterate the party coordinators' incumbent responsibility for cockpit voice recorder (CVR) and flight data recorder (FDR) security. Additionally, take technical custody of the air traffic control (ATC) tapes in order to apply the same security procedures to it as are applied to the CVR. Release CVR, FDR, and ATC readouts or transcripts to the parties on a need-to-know basis only.

Response.--The Safety Board acknowledges its responsibility for the security of CVR and FDR information and has recently developed new procedures to safeguard this information. The Safety Board intends to review these procedures to insure that they provide for maximum security without impeding an investigation.

The Safety Board believes that every party coordinator has been made aware of his or her responsibility for CVR/FDR security and for other aspects of investigation. (See appendix B.) Nevertheless, leaks have occurred primarily where release of the information apparently would serve the purpose of a party or an individual. Ideally, only those parties and individuals directly involved in the investigation who require the CVR/FDR information to guide their investigative activities would be given access to CVR/FDR information. However, as a practical matter, each of the parties believes it has a need or right to know the information on the CVR/FDR and to share it with associated groups. Consequently, more persons than necessary come to share CVR/FDR information, greatly diminishing the control the Safety Board can exercise. IIC's are aware of the security problem and stress the party coordinator's responsibilities for CVR/FDR security at the outset of each investigation. However, more emphasis will be given to this issue, and the Safety Board will consider actions to limit or deny access to CVR/FDR information by parties who knowingly disregard security considerations.

The Safety Board does not agree with the recommendation that it should take custody of ATC tapes and give them the same security as CVR tapes. The ATC tapes are recordings of public broadcasts, and therefore, are not subject to any fundamental privacy as are CVR tapes, and specifically the conversations on the cockpit area microphone channel. The current ATC transcription procedure, in which the FAA prepares ATC tape transcripts after the NTSB reviews them for accuracy, is a good procedure and the most efficient means to obtain ATC information during the time critical initial on-site investigation.

4. Recommendation.--Provide an opportunity during the technical review for interested parties to review and comment on the analysis, findings, and recommendations of the investigation.

Response.--The Safety Board disagrees with the recommendation. The Safety Board encourages the full participation of parties in every phase of the accident investigation, and during a public hearing or deposition proceeding. Party involvement includes participation in specialized groups in the investigation and during progress meetings, in public hearings or depositions, and in the formal technical review at the completion of the investigation. Additionally, parties are encouraged to submit conclusions and recommendations to the Board at the end of the field phase of an investigation. (See appendix B.) The party submissions are considered in the preparation of the accident report, and are reviewed and considered by the Board Members. Parties may meet with the IIC, individual investigators, or the report writer at any time to discuss technical issues in the report. However, making draft final reports available to the parties for review would likely encourage leaks to the media and is not likely to enhance significantly the accuracy

of the report. As a result, the Board does not agree that parties should be allowed to review of the analysis, findings, conclusions, or probable cause of an accident report. (See Recommendations 10, 15, and 30.)

5. Recommendation.--Assist the accredited technical advisors on foreign investigations in reaching the site of an overseas investigation.

Response.--The Safety Board will continue to attempt to expedite the issuance of visas, secure official confirmation of an accident from the State of Occurrence, expedite internal Board procedures to initiate notification of parties and the dispatch of an investigation team, and attempt to assist technical advisors in gaining entry into the State of Occurrence. For accidents in which a U.S. Accredited Representative does not go to the accident site, the Safety Board will attempt to secure invitation for participation by U.S. technical advisors on the foreign investigation team. The experience of the Board, however, is that virtually all delays related to foreign investigations are attributed to visa and notification problems at the State of Occurrance, and not the U.S. Department of State. However, the Board will assist U.S. technical advisors, wherever possible, and will continue to consult with the Department of State to resolve problems as they arise.

6. Recommendation.--Review current CVR, FDR/digital flight data recorder (DFDR) requirements as they interface with the new electronic instruments and components, since information previously retrievable after the fact may no longer be available and new expanded coverage may be required for a DFDR.

Response.--The Board has already done so. (See Safety Recommendations dated July 13, 1982, A-82-64 through -67 on FDR/DFDR and A-82-62 and -63 on CVR's in appendix C.) The Board will continue to advocate the technical advancement of FDR's with regard to required data parameters and CVR's with regard to recording quality. (See Recommendation 48.)

7. Recommendation.--Exercise a high degree of self-discipline when dealing with the media and avoid release of conclusive cause statements to the press or television during the early phases of an accident investigation. Further, all releases of information concerning the accident investigation should be coordinated with the IIC before release.

Response.--Current Board policy not to release conclusive cause statements to the media during the early phases of an accident investigation is consistent with the recommendation.

With regard to the coordination of the release of all accident investigation information with the IIC, the Board's policy is just that. Board Members and Public Affairs Officers on site confer with the IIC at the conclusion of the daily progress meetings and at other times to develop the information to be released about the progress of the investigation. (See Recommendation 59.)

RECOMMENDATIONS SUBMITTED BY THE GENERAL AVIATION ACCIDENT INVESTIGATION WORKING GROUP

8. Recommendation.--Establish a formal, written protocol on party participation in accidents and schedule a review team, including industry representatives, to review the protocol to insure that the shortcomings brought to point by these groups are covered in that protocol.

Response.--The Safety Board has a protocol for party participation during the on-site investigation and the public hearing phases which is set forth in 49 CFR Part 831 and 49 CFR Part 845. The Safety Board believes that these regulations establish adequate procedures for designation of parties to the investigation and to the public hearing. Additionally, current Board orders provide detailed guidance for Board staff regarding party participation in all phases of the investigation. The procedures used by our investigators during the field phase of each major investigation are appended. We have reviewed our procedures in preparation for and as a result of the recommendations from the Springfield Symposium. As a result, the Safety Board does not believe that it is necessary to convene a review team on this issue.

9. Recommendation.--Release a policy statement regarding the delegation of safety/accident investigations to the FAA along with the supporting criteria for such delegation.

Response.--Up until recently, the Board delegated certain accidents to the FAA based on an interagency agreement (Public Notice 1 dated February 10, 1977). When the Board implemented its revised investigative program on January 1, 1982, it prepared a revised public notice reflecting changes in the delegation to the FAA. Although the FAA has agreed to the revised program in principle, it has not yet agreed to specific language describing the revised delegation. The Board hopes to resolve this matter with the FAA and publish a superseding public notice before the end of 1984.

10. Recommendation.--Establish a procedure to provide for review by interested parties of the Board's Safety Recommendations before they are issued.

Response.--The Safety Board does not agree with this recommendation. Prior review of recommendations by parties to whom they might be addressed would undermine the independence of the Safety Board. However, the Board encourages frequent and open dialogue between the Board's staff and the aviation community regarding safety issues before the issuance of the recommendations. (See Recommendations 4, 15, and 30.)

11. Recommendation.--Reestablish a standardized training program for new Board personnel, as well as recurrent training, including, on invitation, industry representatives. This could include a combination of Board and FAA schools, but we believe the standardized training program is required.

Response.--The Safety Board has always requested funding for comprehensive staff training and will continue to do so in the future. Currently, individual development plans are being developed for each Safety Board position to insure that current technical skills, knowledge, and qualifications are maintained throughout a career with the Safety Board through attendance at specifically identified specialized training courses. At the same time, we are exploring means to reestablish a formal aviation accident investigation course, as well as developing plans for standardized recurrent training for both new and experienced employees. Consideration also is being given to conducting an accident investigation course in cooperation with other government and private organizations in which provisions would be made for training industry personnel.

12. Recommendation.--Retain accident investigations; that is, do not delegate fatal and serious injury accidents to the FAA.

Response.--The Board conducts investigations of those accidents which offer the highest potential for increasing the level of safety. This consideration and the constraints of Board resources are, therefore, primary factors in the decision to delegate an accident. In 1983, the Board's 10 field offices investigated 3,355 aviation accidents. Two hundred eleven accidents were delegated to the FAA for investigation of which 46 were fatal. Consequently, the Board, in fact, does investigate most fatal aviation accidents. In 1984, the Board plans to investigate all fatal accidents, except for some which involve agricultural and experimental aircraft since the FAA is not willing to investigate these accidents. For all accident investigations delegated to the FAA, the Safety Board scrutinizes the report and performs quality assurance checks. The analysis and determination of the accident's probable cause are performed exclusively by Board personnel.

13. Recommendation.--Obtain adequate funds and use those funds to keep abreast of current technological advancements made within the industry.

Response.--The Safety Board will continue to request adequate funding to permit the execution of a training program designed to allow its technical staff to remain abreast of current technological advancements. In addition, completion of the training plan described in the response to recommendation No. 11 will enable the Board to include in future budget requests specific funding needs so that the technical capabilities of its staff can not only be kept current but can also be continually enhanced and expanded. The Safety Board also attempts to equip the laboratory with state of the art technology for recorders, metallurgy, and aircraft performance studies. New equipment is budgeted as required.

14. Recommendation.--(a) Convene a seminar similar to the Springfield Symposium in no longer than 3 years; (b) insure that preplanning for the seminar includes industry participation to provide a most effective program; and (c) insure that workshops be scheduled to prepare for actual seminar presentations.

Response.--The Board agrees with the thrust of this recommendation. Future seminars will be planned for periodic intervals. As was done in preparation for the 1983 symposium, industry participation will be solicited. For the 1983 symposium, several planning meetings were conducted which included the FAA, Air Line Pilots Association (ALPA), Airline Transport Association of America (ATA), Aircraft Owners and Pilot's Association (AOPA), Aerospace Industries of America (AIA), General Aviation Manufacturers Association (GAMA), and the RAA. We hope to see active industry participation in the planning of future symposiums. The concept of presymposium workshops is appealing, and we plan to utilize it.

15. Recommendation.--Provide some forum for all parties to an investigation to participate in reviewing the IIC's analysis and for submitting comments for Board consideration at the same time the IIC report is submitted.

Response.--The Safety Board believes it inappropriate for parties to the investigation to review the IIC's analysis or the draft accident report, this is the Safety Board's responsibility. However, as outlined in the response to Recommendation No. 4, parties have ample opportunity to participate in developing the factual record of the investigation and to then comment on the investigation. Furthermore, parties are encouraged to submit in writing to the Board under 49 CFR 845.27 proposed findings, conclusions, and recommendations to be drawn from the testimony, exhibits, and factual documentation developed during an investigation and/or hearing. These inputs by the parties are examined by Board members when the accident report is considered. Finally, parties are free to meet with the IIC or individual Board Members to discuss their view of the accident. (See Recommendations 43, 10, and 30.)

16. Recommendation.--Reinstitute the standard debriefing that is now held by some IIC's at the close of the field investigation for all parties to the investigation. This has been done in the past, and it is still being done, but only in certain areas and only by certain IIC's.

Response.--It has always been the Safety Board's policy for IIC's of major and partial-team investigations to review all field notes, distribute the notes to the parties, and outline additional investigative activities before the on-site phase of the investigation is closed. A technical review of the entire investigation is conducted at the close of every major and partial-team investigation before the report-preparation phase begins. All parties participate in the technical review.

A similar policy applies, where feasible, to general aviation accidents investigated by field office IIC's. Although the investigation team in these accidents is usually small, there remains a need for a debriefing and/or technical review. This will be conducted by the IIC at the close of the on-site accident investigation activity.
(See recommendation 35.)

17. Recommendation.--Establish procedures to require more and better photographic coverage during accident investigations, especially for general aviation accidents. We believe that a better photo log should be kept to better identify the photographs, and we do not believe that the photographic work should be done by what we now know of as instant cameras, although that could change as technology in that area advances. We are concerned about the reproducibility of such photographs. We also believe that photographs should be taken with 35 millimeter cameras.

Response.--The Safety Board agrees with the intent of this recommendation and is working to upgrade the quality of its photographic coverage, as well as the control of photographs. Photographic coverage and documentation of the accident has been stressed to major and partial-team IIC's, with all field IICs, and all investigators in the Board's Bureau of Technology. The need for high quality photographs and positive identification of photographs taken during an investigation has been emphasized. Additionally, training classes have been conducted to improve photographic skills. Finally, IIC's are providing more photographic coverage, when warranted, in the public docket/field accident report.

18. Recommendation.--Preserve all photographic negatives even though the photographs themselves may not be used in the report.

Response.--The current Safety Board policy is that negatives of all photographs that appear in a report or that are included in the accident investigation file should be preserved. All accident investigation files are now being put on microfiche and all negatives for photographs contained in those files are mounted in aperture cards. This process preserves the negatives and facilitates reproduction of the photographs.

Currently, the number and type of photographs vary considerably by type of accident and with the investigative practices of the individual investigator. This matter is currently under study with a view toward formalizing a more comprehensive and standardized procedure for photographic documentation of the accident site.

19. Recommendation.--Consider videotaping accident scenes and accident investigations at the accident scene.

Response.--The Safety Board has recently acquired a color video camera and the necessary minimum accessories to videotape accident scenes during selected major investigations. The equipment is currently available only to headquarters personnel. A study has been started to develop criteria, procedures, personnel requirements, and equipment requirements to provide for videotape coverage of investigations. Additionally, investigators normally obtain videotape recordings and photographs made by local media stations and newspaper persons.

20. Recommendation.--Improve witness statement forms. Perhaps make a checkoff list or something similar to assure that adequate information is obtained from a witness or, at least, that questions asked of a witness provide for adequate information.

Response.--The Safety Board agrees with this recommendation. The Board has periodically provided, and will continue to provide, investigators training in witness interrogation. Recently the Federal Bureau of Investigation (FBI) conducted a formal witness interrogation training course for headquarters and field investigators. Additionally, the Board's witness statement form has been revised and is now being tested functionally. The new witness statement form will be completed and in use by October 30, 1984.

21. Recommendation.--Coordinate with the FAA to include the use of en route readout data for flightpath determination in the accident investigation.

Response.--The Board has been doing this for the past several years. Programs are now used to plot ground tracks and flight profiles, to calculate aircraft performance data from radar information, and to prepare cockpit visibility displays.

Although ATC radar does provide information on altitude (assuming the altitude encoding transponder is operational and the aircraft signal is within range of a ground-based antenna), position, and groundspeed, the data are limited in their usefulness in an accident investigation. Data points are not sampled frequently enough, nor is the data sufficiently precise, to derive more than trend information regarding the flight. Also, secondary radar returns frequently are not received where control of an airplane has been lost or when it is in unusual attitudes. Finally, radar data are not always recorded, and therefore, are not available from some ATC facilities.

On August 31, 1982, the Safety Board made Safety Recommendations A-82-106 through -111 to the FAA regarding the design and installation of small, lightweight, and inexpensive flight recorders (both voice and data) for use in multiengine, turbine-powered general aviation airplanes. The Board believes that recorded data, supplemented by radar data, will greatly reduce the problem of general aviation high performance aircraft accident reconstruction.

22. Recommendation.--That the IIC coordinate the preservation and release of wreckage to make sure that wreckage is preserved until the accident investigation is complete and that all parties are satisfied that the wreckage no longer need be retained.

Response.--The policy of the Safety Board is, when feasible, to recover and retain wreckage and components to the extent necessary and practical for the determination of probable cause. All IIC's have been instructed to insure through coordination with the parties, that components and wreckage are no longer required for causal determination

before the parts are released. However, the role of the Safety Board is to preserve components and wreckage until the Board has completed its investigation; not to be a repository of wreckage for the parties. While we will attempt to notify parties of our intent to release components and wreckage once we have finished our investigation, we will not store parts.

23. Recommendation.--Provide a summary of available information and methods of obtaining such information, such as computer-generated accident statistics and data. It appears that there are persons within industry who are not aware of what is available from the NTSB. New personnel coming into industry are not acquainted with available data sources.

Response.--Data on accidents are stored in the Safety Board's automated data base. This computerized data base is used to answer inquiries from industry as well as to serve the Safety Board's needs for data. Reviews of air carrier accidents and general aviation accidents (using data from the computerized base) have been and will continue to be produced annually. The Board also publishes from time to time special statistical reports to highlight and analyze special issues in aviation.

The Safety Board has prepared for public dissemination a brochure which lists all Board publications, including statistical reports. This brochure will be updated periodically. (See Recommendations 29 and 36.)

24. Recommendation.--Protect reports more diligently from use in litigation.

Response.--Both the Independent Safety Board Act and the Federal Aviation Act provide that a Board report shall not be submitted in evidence or used in any suit for damages arising out of any matter mentioned in such report. The courts have consistently held that the "report" referred to in the statute is that containing the determination of probable cause and does not extend to the investigator's factual report or the other materials in the docket. This distinction is acknowledged in Part 835 of the Board's rules, which governs testimony of Board employees in civil litigation.

Attorneys representing parties to civil litigation, as well as the courts adjudicating these cases, are generally well aware of the above statutory proscription, which is quoted in the foreword of "Aircraft Accident Reports - Brief Format" which contains the cause determination in all civil aircraft accidents. We believe the Board should not attempt to extend the proscription to factual reports prepared by investigators. Such an extension would likely require legislation, and if achieved, would increase the pressure from claimants and insurers to participate in the investigation since they would no longer be able to use the factual reports in litigation.

25. Recommendation.--Take necessary action with the FAA on registrations to identify airplanes and engines reported to have been destroyed and preclude the recertification of such products in order to protect consumers in the future.

Response.--The Safety Board is aware that there may be a significant problem with the certification of bogus or rebuilt aircraft using documentation from destroyed airplanes. In fact, the Board has been collecting data on this issue, and is currently analyzing these data to determine the appropriate solution to eliminate this problem.

26. Recommendation.--Eliminate ultralight vehicles from Board activity so that very, very thin resources will not be diluted further.

Response.--The reasons for the Board's decision to investigate a limited number of ultralight vehicle accidents is set forth in the policy statement it issued on this subject. (See appendix D.) Based on its experience during this past year, the Board expects to investigate 150-165 accidents each year. This level of activity has not had a substantial impact on other aviation investigation activities, but it is a clear indication of the Board's concern regarding the safety concerns of this rapidly growing area of aviation. Moreover, we view this investigative activity as short term one focusing on a "safety issue," rather than involving a continuing oversight responsibility. Therefore, as soon as we believe that the most significant problems have been identified and remedial action is underway, the resources devoted to ultralight accident investigations will be shifted to other aviation safety issues.

27. Recommendation.--Confer with the National Aeronautics and Space Administration (NASA) and the FAA to develop a safety reporting system to include accidents.

Response.--The Aviation Safety Reporting System (ASRS) is a well accepted and valuable tool for learning about potential problems within the aviation system; the Safety Board has used this system during the course of doing studies and investigations. The success of the ASRS, of course, depends in large measure on the concept of anonymity of the reporter of incidents.

Data obtained during the official investigation of an accident, however, is a part of the public record, and anonymity is not possible. Thus, it is not realistic to combine an aviation accident data base and the ASRS data base. This does not preclude the use of both data bases when performing aviation safety studies or accident investigation analysis.

Both the NTSB aviation accident data base and the Aviation Safety Reporting System (ASRS) are to be included in the Aviation Safety Analysis System (ASAS) being developed by the FAA. Thus, through ASAS there will be a direct link for reporting of both accident and incident data.

28. Recommendation.--Distribute NTSB recommendations to all involved persons.

Response.—The Board has placed, and will continue to place, a high priority on assuring that safety recommendation information is distributed to interested persons in the transportation industry. The NTSB has established the following means to assure the adequate distribution of safety recommendations to interested parties:

> Addressees.--Individual copies of recommendations are sent to all addressees of the recommendations on the day that they are approved.
>
> Involved Persons and Parties to the Investigation.--An individual copy of any applicable recommendation is sent, on the day the recommendation is approved, to any involved person or party to the investigation. An involved person would be an operator, manufacturer, or organization which was the subject of the recommendation, but not the addressee.

Federal Register Citation.--All recommendations and responses thereto, are published in the Federal Register. The recommendations are listed verbatim and the responses are summarized.

NTSB Distribution.--Safety recommendations are sent free of charge, through NTSB-maintained mailing lists, to Federal, State, local and foreign transportation agencies; educational institutions, public libraries; nonprofit public safety organizations, inter-national transportation organizations; and the news media.

National Technical Information Service Distribution.--Safety recommendations are also distributed through subscription lists maintained by the National Technical Information Service to other interested persons who pay a fee covering the cost of printing, handling, and mailing.

RECOMMENDATIONS SUBMITTED BY ACCIDENT REPORTS/RECOMMENDATIONS WORKING GROUP

29. Recommendation.--Accelerate production of its statistical data. Three-year-old data are not particularly useful. General aviation has not received a statistical breakdown of general aviation accidents since 1979. These statistical breakdowns highlight critical areas; reports should be published annually, by May of the following year.

Response.--The Safety Board is very much aware of the need to expedite the dissemination of accident data to the general aviation community. The Board will accelerate the preparation of the annual reviews of aviation accidents and other statistical reports derived from the Board's aviation data bases. The recently installed word processing equipment and the communications link between it and the central computer should enable us to produce our statistical reviews more quickly than has been possible in the past.

The Safety Board believes that the accuracy and completeness of the data and its utility to the aviation community are as important as timeliness. A great deal of effort has gone into improving the quality of our aviation accident data. The data system was completely overhauled in 1982 (new hardware, software, data forms, and procedures); further improvements were made with the redesign of the data collection form in a format acceptable to both NTSB and FAA.

One component of the new data system, the preliminary data base, is of particular importance to a discussion of timely dissemination of accident data. Much of the basic factual data is stored in the preliminary data base within a few days of the occurrence of an accident. This base of preliminary accident data has facilitated the release of a preliminary report in early January on the previous year's accident statistics. Though not as detailed as data from the full accident data base, the preliminary data do make possible a rapidly retrievable and timely overview of aviation safety.

The Safety Board's goal is to publish general aviation reviews and air carrier reviews in the fall of the year following that of the accident occurrences. The 1980 Air Carrier review which included Parts 121 and 135 operations, was published on January 14, 1983. Our plan for achieving that goal is:

Report	Publication Date	Factors Affecting Schedule
1980 General Aviation	Spring 1984	Report format changed extensively.
1981 General Aviation	Summer 1984	No changes anticipated.
1981 Air Carrier	Summer 1984	No changes anticipated.
1982 Air Carrier	Fall 1984	Extensive data base changes, probably requiring report format changes.
1982 General Aviation	Fall/Winter 1984	Extensive data base changes, probably requiring report format changes.
1983 General Aviation	Winter 1985	Substantial data base changes, probably requiring report format changes.
1983 Air Carrier	Spring 1985	Substantial data base changes probably requiring report format changes.
1984 General Aviation	Fall 1985	Stable data base and only minimal changes to report format.
1984 Air Carrier	Fall 1985	Stable data base and only minimal changes to report format.

(See recommendations 23 and 36)

30. Recommendation.--Before providing a draft report of an accident to Board Members, the IIC and/or the report writer should convene coordinators and allow them to provide comments on the accuracy and completeness of the report. Tight security could be maintained so that the report's contents would not be distributed prematurely. In cases where disagreements among the parties cannot be resolved, parties should be allowed to attach a dissenting opinion to the draft report and present views to the Board Members.

Response.--The Safety Board disagrees with this recommendation. The same issues are discussed in the responses to recommendations 4 and 15. The Board believes parties have ample opportunity to provide comments about the accuracy and completeness of factual reports developed during the investigation. The Safety Board is responsible for assuring that the analysis, findings, probable cause, and recommendations are consistent with the facts. Additionally, if the Board allowed parties to examine the draft report, legally the same privilege would have to be extended to all organizations or the media. This would be an unacceptable situation.

Upon completion of the field phase of the investigation and the technical review, party representatives should have a complete understanding of the investigation and the safety issues involved. Parties are encouraged to submit in writing their recommendations about findings and conclusions which they believe the Board should draw from the investigation. Although this option is not exercised by parties as frequently as the Board would like, it can be an effective means of communicating directly with the Board Members on specific issues. (See Recommendations 4, 10, and 15.)

31. Recommendation.--Allow one spokesman for each designated party to an investigation to provide information to the Safety Board during "Sunshine" meetings when discussions between the Board Members and the staff reveal a lack of knowledge or understanding of the issue being discussed.

Response.--The Safety Board encourages representatives of parties to submit written comments concerning the findings and conclusions of an investigation. Additionally, party representatives may meet with individual Board members to discuss the aspects of the investigation before the "sunshine" meeting. However, we do not believe that parties should participate in discussions related to the analysis of the report, or that parties should be involved in discussions during the open Board meetings for the following reasons.

(1) The parties have ample opportunity to comment on the investigation before the draft report is sent to the Board; (2) the proposed procedure would cast the Board report as the resolution of the adversial position status of the parties; (3) the staff and the Board would be put in the role of adversaries; and (4) the discussion of the report would assume the posture of an actual legal proceeding. Further, the purpose of the Government in the Sunshine Act is to allow the public to observe the deliberations of a Government agency, not to participate in them. Although the Act does not prohibit public participation, the Safety Board, as well as virtually every other agency subject to the Act, has chosen not to allow public participation.

The Safety Board is confident that the analyses of an accident and the determinations of probable cause are reached in a competent manner and that the present discussion format involving the Safety Board and its staff provides the necessary resolution of the issues. (See Recommendation 32.)

32. Recommendation.--Allow oral arguments before the Safety Board by parties to the investigation. These arguments should be made in an informal setting at which open discussion and free flow of information are permitted. The Safety Board should take every opportunity to gain information upon which to base its conclusions regarding causal factors.

Response.--In our judgment, an "oral argument" made before the Board adopts an accident report is neither necessary nor advisable. Under current procedures, the parties participate fully in the factfinding portion of the investigation, including the technical review in the case of major accidents. In addition, they are requested formally to provide input into the analytical process through the submission of proposed findings and conclusions. Finally, parties can contact Board members directly to discuss aspects of the investigation. In view of the nature of the Board's investigations, these procedures are a more appropriate means of allowing party participation than "oral argument," which is more legalistic in form and which would cast the Board's report as a resolution of the adversarial positions of the parties.

By a recent amendment to Part 845, a procedure termed "oral presentation" was added as a supplement to a petition for reconsideration. The "oral presentation" is allowed where there is "an affirmative showing that the written request for reconsideration or modification is insufficient as a means of presenting that party or persons position to the Board." This procedure has yet to be utilized. (See Recommendation 31.)

33. Recommendation.--Adopt the all-cause concept used successfully in the military and other States. Thus, all factors contributing to an accident would be given adequate consideration and safety recommendations would be more widely applied. The probable cause concept promotes court findings which does not enhance safety, nor prevent future accidents.

Response.—We believe the probable cause statement should reflect the causal chain where it is apparent; it can include as many causes or contributing factors as appear to be justified by the facts. Section 304 of Public Law 93-633, "Transportation Safety Act of 1974," mandates the Board to determine the cause/or probable cause/or causes. The Board currently approaches the subject in two different ways. In all of its major accident reports, it uses a narrative statement of probable cause(s) and factors which contributed to the cause of the accident; it uses a sequence of events and a list of causal factors in all accident reports published in the "brief format."

The Board generally believes that the narrative format is the appropriate vehicle for setting out probable cause in major accident reports. The format allows the Board to address each element of the cause and the contributing factors in a logical sequence, while the underlying rationale for the causal determination is presented in the body of the report. On the other hand, reporting a number of unweighted factors as in the all-cause concept dilutes the impact of the central safety message of the accident. In the current format, these factors are placed in a narrative causal statement in a way which is related to the unfolding of the accident. The Board has consistently emphasized that the order in which the causal/contributing factors are set forth in the narrative causal statement is not based on their relative significance.

The Board is aware that the U.S. Air Force and U.S. Navy use all-cause listing formats, and we believe that it is an acceptable procedure for determination of cause. However, the Safety Board believes that the probable cause/contributing factors narrative which has served the needs of the U.S. public well should not be discarded without clear and compelling reasons. Following a thorough staff study, the Safety Board will formally consider the need for change.

34. Recommendation.--Utilize more effectively the service of the National Weather Service (NWS) in field investigations and during the preparation of an accident report.

Response.--The Safety Board invites full party participation by the NWS in all aviation accidents where it is appropriate. Additionally, Safety Board meteorologists perform weather studies in conjunction with other aviation accidents. These weather studies use meteorological data and services of the NWS. As a result, the current Board policy insures that the NWS is either invited to participate as a party, or is employed as a resource in every major or field aviation investigation wherein weather is a factor.

The Safety Board has scheduled a meteorological training program to update Board investigators about meteorological investigations, and the NWS resources that are

available during an investigation. Additionally, IIC's and Safety Board management will continue to review accident reports to insure that weather issues are addressed completely and accurately.

However, as in other areas of the investigation, the final analysis of weather data, the accuracy of weather forecasts, and the significance of weather factors in the accident cause must remain the responsibility of the Safety Board. The NWS, as with other parties, may submit recommendations and conclusions to the Board.

35. Recommendation.--Continue the current policy that the Safety Board have a technical review including the representative of each party to the investigation after the data gathering phase has been completed.

Response.--The Board notes this endorsement, but points out that its policy has limited applicability to the average general aviation airplane accident investigation. The technical review of data by parties to the accident must, for the most part, be concluded at the final debriefing following a conclusion of on-site accident investigation activity. Field investigators will attempt, whenever possible, to conduct a technical review at the close of each field investigation. Representatives of each party present at the technical review will have the opportunity to review the factual data at that time. (See Recommendation 16.)

36. Recommendation.--Publish again special studies concerning general aviation accidents but with particular emphasis on analysis of nonfatal accidents. The proper analysis of these accidents would be more useful in pilot training and hopefully in the prevention of future accidents. The current computed peaks of accidents are not adequate for this purpose, nor is the current listing of cause/factors.

Response.--The Safety Board has recently changed its policy regarding the selection of accidents for investigation by its field staff in order to emphasize certain safety issues. The current selection criteria include: accidents involving VFR into IFR conditions; accidents involving low-time pilots (for assessing the effects of flight instruction); and accidents occurring after a loss of power on light twin-engine airplanes. Safety studies will be prepared in these areas, and reports will be issued which should be helpful in pilot training. The Safety Board has published a statistical review of alcohol use in aviation and a safety study about airport certification. (See Recommendations 23 and 29.)

37. Recommendation.--Convene an industry group to review the statistical methods used to determine accident rates of individual air carrier airplane types.

Response.--The Safety Board has had a continuing dialogue on the reporting of accident data and the statistical methodologies used with various industry groups including the Air Line Pilots Association (ALPA), the Regional Airline Association (RAA), and General Aviation Manufacturers Association (GAMA). The Board welcomes these discussions and considers carefully any recommendations for changes in the reporting of such data.

As a result of issues raised at the 1983 Springfield Symposium and subsequently in letters to the Board, we will request from all aviation groups that have expressed an interest in these issues, a written discussion of all deficiencies they perceive in the reporting of aviation accident data. The Board's staff will review and analyze the

comments received. The Board will then develop a program to address them, to the extent possible, including convening meetings, if warranted, with all concerned parties. The parties could include the Civil Aeronautics Board, the Federal Aviation Administration, the Office of the Secretary of the Department of Transportation, the Airline Pilots Association, the Regional Airline Association, the General Aviation Manufacturers Association, the National Business Aircraft Association, and any other groups that express concern.

38. Recommendation.--Do not sacrifice report quality in order to meet schedule deadlines.

Response.--The Safety Board agrees strongly with this recommendation, and it does not believe that quality is being sacrificed for any reason. Accident investigation and report preparation schedules are important to ensure that workload is managed efficiently. The current Board preparation schedules, however, are sufficiently flexible to allow high quality investigations and reports. Staff has been advised that the conduct of thorough investigations and the preparation of quality reports takes precedence over adherence to accident report preparation schedules.

39. Recommendation.--Make public the reason an individual Board Member did not participate in the adoption of a report.

Response.--Board Member participation in accident reports for calendar year 1983 was 93 percent. In most cases, when a Board Member is not able to participate in a Board meeting an explanation of the Board Member's absence is announced by the Chairman or presiding Board Member at the beginning of the meeting. It is, therefore, a part of the public record (transcript) of that open Board meeting. The most prevalent reasons for such absences are participation on go teams or conducting public hearings.

40. Recommendation.--Publish corrected information described in its publications and in the computerized accident data in its possession in a manner in which they could be acquired or accessed.

Response.—The Safety Board concurs with this recommendation and has a policy to publish corrected information when a change or amendment to a Board publication is issued after the basic document is distributed.

Currently, it is Board policy to announce corrections to its accident reports by means of an errata sheet. An errata sheet for a particular report is printed and distributed at the back of the next published report of the same publication category (i.e., aviation report, safety study, etc.). Consequently, persons with subscriptions to Board publications receive automatically corrections to previous reports. Also, all persons who request copies of the report, either from NTSB or NTIS, subsequent to the issuance of the errata will receive the corrected information with the report.

Corrected and/or additional data affecting an accident investigation become a part of the appropriate accident file. These new data are then sent to parties to the investigation by the IIC. The Public Inquiries Section send the new data to any other persons who request the accident file information, including previous requestors.

Any changes in data contained in NTSB's automated data system are entered by the Bureau of Field Operations. Subsequently, any party or individual requesting computer

data will receive that updated information upon request from the Safety Board's Public Inquiries Section (AD-46).

41. Recommendation.--Provide advance notice to recipients of proposed recommendations before the adoption of those recommendations by the Board.

Response.--Board policy now requires that, wherever practicable, the staff notify recipients of proposed safety recommendations, either before a meeting at which the Board Members will discuss the recommendations or when voting sheets are sent to the Members when the vote is to take place in their offices. In addition, it is the Board's policy that recipients of recommendations be notified when the Board adopts safety recommendations and provided copies as soon as practically possible.

42. Recommendation.--Require Board staff to include in reports submitted to the Board the method of technical analysis used to arrive at its conclusions and recommendations. Recognized analytical methods which have been subjected to peer review should be used and displayed in the reports. Examples of analytical methods include the truth table method, used by one industry member.

Response--The Safety Board concurs with the thrust of this recommendation and is always interested in methods to enhance its analytical techniques. The Board uses recognized analytical methods, when applicable, in the analysis of accident data to support findings, conclusions, and recommendations. The policy of the Board is to include in accident reports the method of technical analysis used to support conclusions and recommendations.

43. Recommendation.--Avoid misrepresenting an hypothesis as an absolute fact in Board reports. Opinion or analytical interpretations should be so labeled.

Response.--The Board concurs in the thrust of this recommendation and has conscientiously attempted to separate fact from hypothesis in its reports. It will continue to make every effort to insure its reports do not represent a hypothesis as fact and that opinion and analytical interpretations are so identified.

RECOMMENDATION SUBMITTED BY WORKING GROUP ON HUMAN FACTOR/HUMAN PERFORMANCE IN ACCIDENT INVESTIGATIONS

44. Recommendation.--Evaluate and determine the influence of stress factors, such as fatigue and other acute stressors, as they relate to accident investigation. Make determination and evaluation of stress factors a mandatory element in every accident investigation.

Response.--Evaluation and determination of stress factors as they relate to the cause(s) or potential cause(s) of an accident have been, and will continue to be, an item of major emphasis and concern to the Board. Past Safety Board accident reports have identified fatigue or physiological stress as a cause or factor, and other Board reports have discussed the potential of these factors in causes of accidents. The Safety Board established the discipline of Human Performance in 1980; it has made great progress in developing formal procedures to investigate human performance, including physiological and mental stress factors as they relate to accident causation. The importance which the Board attaches to this area is reflected in the fact that as of October 1, 1983, a separate

Human Performance Division was established. The Board agrees that analysis of stress factors should be a mandatory element of an investigation of accidents in which human performance is involved. (See Recommendations 47, 49, 51, 52 and 54.)

45. Recommendation.--Automatically grant immunity from enforcement proceedings arising from Federal Air Regulations to all persons interviewed as part of an aircraft accident investigation. This will enhance Safety Board investigations.

Response.--The Board's authority to grant immunity is extremely limited. Under the only applicable statute, the Board must first obtain the approval of the Department of Justice; immunity can only be granted for criminal proceedings, and thus would not extend to FAA enforcement actions. The Board has never sought authority to grant immunity under this statute. The Board will, where requested to do so by the witness, exclude any FAA representative from a witness interview. The Board will also, as it has on several occasions in the past, ask the FAA to delay enforcement action where it interferes with the Board's investigation.

46. Recommendation.--Recognize that all parties involved in an accident are entitled to medical clearance, including psychological assistance if necessary, before an interview.

Response.--The Safety Board respects the rights of survivors of an accident. It recognizes that survivors must be mentally and physically able to provide a lucid account of their actions, experiences, and observations if their testimony is to be of value in accident reconstruction. However, of equally valid concern is the need to take survivor statements as soon after an accident as possible before memories become clouded or tainted by personal rationalizations or conversations with third parties. While in the past there may have been some exceptions, it has been the policy of the Board for sometime that investigators will obtain a medical clearance from the attending physicians or other authority before a survivor is interviewed. Pilot and flight attendant organizations should counsel their members that the Board will balance their need to recuperate sufficiently from the accident ordeal with its need to obtain timely first-hand information for accident reconstruction and accident prevention purposes. Additionally, all persons should be aware of their right of representation by counsel when providing testimony to the Safety Board.

47. Recommendation.--Establish a working group consisting of persons with professional and operational expertise to formulate procedures for conducting human factors and human performance investigations making use of available expertise from all other outside organizations.

Response.--The Safety Board only recently completed development of a formal procedure for investigation of the human performance aspects of accidents. In the development of this protocol, experts in the research, Government, industry, and academic communities, including the Air Force School of Aerospace Medicine, NASA/AMES, the Naval Health Research Center, the Naval Safety Center, and Canadian human factors accident investigators were consulted. Further, the extensive data which has been accumulated on all of the factors that can affect and interact with human performance, as well as the effectiveness of techniques previously used by the Board, were used to develop the procedure. Thus, the Board believes that it has not worked in isolation to develop its human performance investigation procedures and that the procedures reflect the consensus of expert opinion and documented data on the human

performance aspects of accidents. The protocol will continue to be refined in order to improve the Board's investigations. The Board will continue to conduct human performance investigations along the guidelines established by its procedures as it refines and improves upon the procedures. The human performance factors that need to be investigated are defined and must be pursued to investigate an accident adequately and to improve transportation safety. Nevertheless, the Board agrees that consultation will be helpful and it will continue to seek views of parties to investigations and recognized experts to refine its human performance program. The Safety Board has established a Human Performance Division within the Bureau of Technology in order to bring together its expertise to accelerate the development of this important program. In fact, the Human Performance Division, in concert with the International Society of Air Safety Investigators participated in a human performance symposium in early 1984. The symposium brought together many of the leaders in human performance subjects to discuss investigative techniques and procedures. (See Recommendations 44, 49, 51, 52, and 54.)

48. Recommendation.--Require that for airplanes having digital flight control systems the DFDR's record control modes and control input, including automatic inputs and responses, to aid in accident investigation.

Response.--We agree, and have previously addressed this subject in Safety Recommendations A-82-64 through -67, issued to the FAA on July 13, 1982. (See Recommendation 6.)

49. Recommendation.--Establish a standardized guideline for use by human factors/human performance group members, including a list of documents required to expedite the investigation, such as aircraft floor plans, flight attendant manuals, and training records, as well as a brief outline of the information required in the course of the human factor/human performance interview. Further, continue activities already begun or being developed to standardized the approach to the human factors/human performance investigation.

Response.--It is appropriate to point out here that the terms "human factors" and "human performance" often are used interchangeably as describing a single discipline or investigative area. However, they involve different topics. Human factors deals with the following matters: occupant survival, crashworthiness, injury causation, cabin safety, crash/fire/rescue, and disaster preparedness. Human performance, on the other hand, deals with factors affecting the behavior of the operator or other persons involved in circumstances leading to an accident, including their relationship to the task, the machine, and the environment. In other words, human factors deals primarily with survival issues; human performance deals with accident causation issues. To avoid further confusion between these two disciplines, the Board redesignated the Human Factors Division as the Survival Factors Division, when it established the new Human Performance Division. In response to the subject recommendation, the Safety Board developed the very comprehensive formal procedure described above which deals specifically with the enumerated items in this recommendation. A copy of that procedure is available on request. The Board's Survival Factors Division has for many years provided training to flight attendant groups in accident investigation procedures related to survival issues and will continue to do so, as workload allows. (See Recommendations 44, 47, 51, 52, and 54.)

50. Recommendation.--Recognize the human factors/human performance group need to hear CVR tapes, as well as reading CVR transcripts.

Response.--The Board agrees that the work of the human performance group, but not the survival factors group, would be facilitated if it were to hear the CVR tape as well as read the transcript in certain accident investigations. Coordination between the CVR group and the human performnce group will be supervised by the IIC. However, the CVR group must be allowed to complete its work uninterrupted, so that a complete and accurate transcript can be developed expeditiously. Accordingly, the human performance group would hear the CVR tape only after the CVR group had been dismissed and the transcript approved; the human performance group would be subject to the same security provisions as the CVR group. Additionally, individuals on the human performance group must understand that they have no right to hear the tape as individuals, but only in the presence of other members of the group.

51. Recommendation.--The human performance group's initial focus should be on the development and coordination of investigative methodology appropriate for (a) go-team use and, (b) single field investigator use.

Response.--With respect to the development of an investigative methodology for human performance go-teams, the response to recommendation No. 48 applies. With respect to human performance investigations by field office investigators, the Safety Board developed a form (6120.4) and began using it in January 1982 in order to collect human performance data from individual accidents. Additional training is planned for field investigators to improve investigation of human performance issues. (See Recommendations 44, 47, 49, 52 and 54.)

52. Recommendation.--Include in the human factors/human performance group such disciplines as medical, psychological, operational, and human engineering, and strive to have generalists available to them. Also, supplement that expertise with expertise from outside the agency, as appropriate to the specific investigation.

Response.--Not only is the human performance methodology which has been developed organized along the lines suggested in this recommendation, but also the Board has hired experts in these areas. Thus, the Board's activity is consistent with this recommendation. As in other area's, the Board's investigative process relies heavily on outside expertise, and it will continue to bring into its investigations the required expertise to supplement its resources. (See Recommendations 44, 47, 49, 51, and 54.)

53. Recommendation.--It is recommended that human performance groups be involved in analysis to a similar extent as the airplane performance group.

Response.--The Board expects the members of any group formed during an investigation to maintain an effective and ongoing dialogue throughout all phases of the investigation. Factual information is shared with all parties as it becomes available. Furthermore, group members are encouraged to participate in the analysis phase by providing commentary on the factual reports prepared by the Board investigator. However, the final analytical report must be an in-house and privileged effort prepared by Safety Board personnel in which the staff presents candid views to the Board. The official public report of an accident adopted by the Safety Board may or may not accept the analyses of the investigators who worked on the accident.

54. Recommendation.--Use outside industry consultants to substantiate methodology and analytical techniques and call upon outside expertise wherever they can be of assistance in accident investigation.

Response.--Again, the Safety Board has not developed its human performance investigation procedures in isolation, and the Board will continue to solicit comments from experts in the field in the development of procedures to investigate the human performance aspects of an accident. (See Recommendations 44, 47, 49, 51, and 52.)

55. Recommendation.--Include the type of testing, namely static or dynamic, as appropriate in those accidents were passenger seat failure is a factor.

Response.--The intent of this recommendation is not entirely clear. The FAA in 14 CFR 25.785 requires that seats be tested statically to certain inertia loads. Although the Board understands that certain manufacturers will test their seats dynamically as well, there currently is no requirement for this procedure. If the subject recommendation implies that the Safety Board should perform tests on those seats that have failed in an accident to determine that the seats were airworthy with respect to the required inertia loads, it must be pointed out that the only useful information to be gained by performing such tests would be to prove that the seats indeed meet the FAR standards. The Safety Board is on record as having stated that it does not believe the current static strength standards for seats are adequate. In the past, the Board has performed seat strength tests in cases where it is believed that the seat design did not meet standards or that the seats had deteriorated below original standards, and it will continue to do so in the future. The Board has had an extensive dialogue with the FAA, and it has made a number of recommendations with respect to the need for improved testing of aircraft seats, including the need for more realistic dynamic testing criteria. The Safety Board currently is cooperating with the General Aviation Safety Panel (GASP), composed of industry and government representatives. This panel is in the process of preparing recommendations to the FAA on specifications for the design and testing of seats and restraint system in general aviation airplanes. These specifications will include dynamic testing criteria for these systems. The FAA anticipates that a Notice of Proposed Rulemaking will be issued on this safety issue by July 1984. It also is anticipated that similar requirements for transport category airplanes will be forthcoming as a result of FAA research in this area.

56. Recommendation.--Recommend that FAA research various types of water survival equipment other than that currently used on civilian aircraft.

Response.--The Safety Board has submitted recommendations to the FAA on the entire spectrum of passenger safety and survival, including equipment for water survival. On June 15, 1981, FAA Administrator Helms assured the Safety Board that he had directed an analysis of the whole question of survival aids in water landings, "where we are, and our plans for the future." Obviously, the Safety Board agrees with the thrust of this recommendation. It will closely monitor developments in this vital safety area.

57. Recommendation.--That the U.S. adopt the ICAO standards as they pertain to rescue and firefighting, and that the Board encourage further testing and possible rulemaking in regard to minimizing the dangers of combustion and toxicological poisoning in the cabin environment.

Response.--The Board examined the entire spectrum of crash/fire response at airports in the United States, including firefighting and rescue equipment. A final report of the study was published in April 1984, which contains Safety Recommendation A-84-31. This recommendation urged the FAA to adopt ICAO standards for water and extinguishing agents.

With regard to the second part of the recommendation concerning the hazards of burning materials in aircraft cabins, the Safety Board has successfully pressed for many of the projects established by the FAA, the aircraft industry, and NASA to investigate means to control fires in aircraft. These projects include the anti-misting kerosene (AMK) tests conducted at the FAA Technical Center (FAATC), the fire-blocking seat project conducted by NASA/AMES, as well as the full-scale fire tests project at FAATC and many others conducted by the aircraft manufacturers. The Board recognizes that there are many tremendously complex problems to be addressed in fire prevention and fire retardation in airplane accidents. The FAA has taken action on some of the issues. Recently, Notices of Proposed Rulemaking (NPRM) have been issued on performance standards for emergency lighting in airplane cabins. The FAA has indicated to the Safety Board that it anticipates additional rulemaking relating to fire extinguisher systems and smoke detectors.

As a result of the Air Canada McDonnell Douglas DC-9 accident at Cincinnati, Ohio, the Safety Board issued several safety recommendations. The recommendations addressed the problems in minimizing the dangers of combustion and its by-products in the cabin environment.

POSTSYMPOSIUM RECOMMENDATIONS

58. Recommendation.--Give most attention to interviewing expert witnesses. Possibly because of overreliance on electronic data collection, qualified witnesses are not being interviewed properly. Two classic cases were the jumpseat rider in the Delta/Flying Tiger near collision at O' Hare and the engineer-passenger in the North Central 580 accident at Kalamazoo, Michigan.

Response.--The Safety Board has instituted procedures to upgrade the selection of witnesses and to improve interviewing techniques. In some cases, all the important witnesses were not interviewed, or sufficient emphasis was not given to their testimony. Accordingly, all IIC's and investigators have been instructed to review their procedures for selecting witnesses, to interview witnesses thoroughly, and to insure that the interviews are analyzed to determine the technical significance of each. Additionally, investigators have been provided with more definitive guidance during on-site supervision by IIC's, and will soon have improved witness forms.

59. Recommendation.--We realize the Safety Board's concern with the provisions of the Freedom of Information Act. In the conduct of press relations in the field, we feel that the Board is going beyond both the letter and the spirit of the Act in making available to the press the most minute details of the investigation while it is in progress.

Response.--Beyond the dictates of the Freedom of Information Act, the Board has a longstanding policy that, as a Government agency, it will conduct openly its activities on behalf of the public.

In dealing with the media at the scene of an accident, the Board Member or Public Affairs Officer on site is confronted by a press corps motivated by one of the oldest of journalism's adages: "Nothing improves the quality of a story like a few facts." We seek to provide facts as they become available because we believe that, to the extent that it is given hard facts the press, will eschew rumor and speculation. However, in all cases, coordination between the IIC and the Board Member or Public Affairs Officer takes place to insure that the information released to the press is accurate and does not hamper the ongoing investigation.

The comment implies that we should draw the line at the availability of "minute details of the investigation." It is our view, however, that if details, despite their apparent insignificance, are the subject of press interest, there is no benefit in withholding them, especially when we know they will soon be a matter of public record as a part of the investigative team's factual reports. Any effort to "screen out" minor details might lead to the erroneous impression that the Board had already come to some conclusions which made that factor causally insignificant, or worse that the Board was seeking to bury the fact. The effect would be contrary to what we believe is desired and would put the Board in a position it is not willing to accept. (See Recommendation 7.)

60. Recommendation.--Do not allow recording devices of any kind during the informal crew interview after an accident in order for this interview is to be truly informational. There have been occasions when transcripts of such recordings were later put forth as crew statements, which they were never intended to be.

It has been stated that if the crew does not give an interview, they will face a deposition. We will accept that challenge if you will give us some rules for deposition hearings. Current conduct of those proceedings is far too nonstandard among hearing officers. We would propose that the same rules be applied to depositions as are applied to public hearings. Proposals for rules of procedure in deposition could be a work project for a joint industry/NTSB working group.

Response.--The policy of the Safety Board is to use recording devices during interviews if the person being interviewed allows the interview to be recorded, and if the Board investigator wants to use a recorder. However, recorded interviews are not to be used in lieu of crew, passenger, or witness statements, nor are they to be used independently of a summary of interview. A summary of interview is to be made from notes taken during the interview, and signed by the party representatives present at the interview. The recording of the interview is a reference to clarify facts. The Board does not use the threat of a deposition to force a person into being interviewed. However, if a person who has significant information refuses to talk with Board investigators, the Board may have no choice but to issue a subpoena to take that person's testimony.

The Board's regulations include no provisions pertaining to depositions in order to afford the Board the necessary procedural leeway to deal with the broad range of situations in which depositions (or sworn testimony) are taken. There are written guidelines in Board orders, and we will strive to ensure that all hearing officers interpret the guidelines uniformly. Generally, where the taking of deposition involves a number of parties and witnesses, the Board's public hearing procedures are followed with respect to the questioning of the witnesses by the Board and party representatives.

61. Recommendation.--Standardize the number of rounds of questions each party is allowed to ask at public hearings. We find Members of the Safety Board have different procedures in this regard, and we propose standardization in that area with one initial round of questions being allowed, and subsequent questions only allowed on subjects brought out since that party's first opportunity to question.

Response.--In view of the need for flexibility, this type of matter is better left to the discretion of the presiding officer rather than being incorporated into a rule or order. It can, nevertheless, be stated that there is a reasonable degree of standardization in this area and that Board Members generally follow the procedure of allowing questions beyond the first round only on subjects brought out since that party's first opportunity to question.

62. Recommendation.--Do not permit the posing of hypothetical questions to crewmembers at public hearings. With the benefit of hindsight, their stated response may well differ considerably from what their actual response would have been in the same circumstances.

Response.--The pilot witnesses called to testify are experts in the subject matter. With the accident conditions as a backdrop, a proper hypothetical question can be a valuable tool to understanding the accident. The key is that there be no distortion of the actual circumstances of the accident in the course of such questioning. The Safety Board will caution investigators involved in public hearings, depositions, and interviews of the problems which may arise from hypothetical questions. Additionally, Board Members and the attorney on the panel will be alerted to forestalling abuses in this area.

63. Recommendation.--Lengthen the short timespan between the accident and the public hearing. Expert witnesses arrive at the hearing only to say that they have not had sufficient time to prepare, as was the case in the recent Pan American Flight 759 hearing at New Orleans. Also, expert witnesses sometimes arrive at the hearing with a mass of data to be distributed at the last minute to the parties, resulting in a lack of effective questioning by the party spokesman.

Response.--Ten public hearings on aircraft accidents have been held in the past 4 years. The average time from the date of the accident to commencement of the public hearing for those cases has been almost 2 1/2 months. Among the most important purposes served by a public hearing into the facts, conditions, and circumstances of a catastrophic aircraft accident is the prompt assurance to a concerned public that the causes of the accident and the means to prevent future similar accidents are being urgently and thoroughly examined. We share the expressed concern with the need for all participants in the public hearing process to be as thoroughly prepared as possible, and it is for this reason that we seldom convene a public hearing immediately following the accident. As a result, it is our view that very few witnesses or parties are unable to prepare properly for a public hearing because of its timing, nor do we believe that additional time would result in better prepared witnesses or parties. We believe that the element of public confidence in the safety of the air transportation system, which the Federal Government is acting to assure, outweighs any further extension of the 60-day preparation period for a public hearing.

64. Recommendation.--Exercise more control over placement of media cameras at public hearings. Many public hearings have actually been press hearings with a little public scattered behind the cameras. Pool cameras might be one solution to the problem.

Response.--The issue of camera placement at public hearings is one to which we have asked our Office of Government and Public Affairs to be sensitive. That office has recently undertaken, where possible, to provide an elevated camera position for television crews so that they can have an unobstructed view of the proceedings without having to be in front of spectators.

The idea of "pooling" is usually limited to exigent circumstances in which space is at an absolute premium, and then priority is given to wire service personnel. That may be satisfactory for the print media in circumstances in which the Associated Press (AP) and the United Press International (UPI) reporters are acknowledged experts or "regulars" on such "beats" as the White House or State Department. But at Safety Board hearing sites, the reporters representing the wire services may not have aviation or transportation backgrounds.

While the idea of requiring that television stations pool their camera coverage is appealing, we understand that such a requirement would involve many problems, including the expense and delay of duplication. Even if there were no compromise in quality, the delay and cost of such an endeavor would be intolerable to the affected broadcast outlets.

65. Recommendation.--Do not allow deposition proceedings in which the press is allowed but the general public is not. Public depositions should be public, and closed depositions should be closed.

Response.--This is current Board policy. The Safety Board does not, per se, invite the public or the press to deposition proceedings. To "invite" the public might suggest that the proceeding itself is open to active public participation, rather than a scheduled roster of witnesses. The Board's Office of Government and Public Affairs informs interested media outlets of a public hearing or an open deposition proceeding in the course of answering the inevitable question of "what happens next" in the progress of the investigation. The Board notifies all parties to the investigation, without regard to whether witnesses in which they might have an interest, however indirect, will be called.

No Board deposition proceeding has ever been open to the press to the exclusion of the public. Even if space is limited, specific space is made available for members of the press, since they serve to disseminate information to a wide audience. However, we cannot recollect any occasion in which the seating available to the public was less than that provided for the press.

66. Recommendation.—Hold a public hearing or specialized conference in followup to the Springfield Symposium to discuss key law-safety issues affecting the Board's air safety investigations. Such issues should include, but not limited to:

- o Designation of "parties" to NTSB investigative proceedings.
- o Possibility of providing confidentiality to statements of certain types of witnesses during investigations.
- o The potential destruction of the Board's authority to withhold analyses from use in litigation if parties are allowed to review such information before its release to the public in report form.

67. Recommendation.—As an interim to the results of (1), grant observer status during the field investigation phase of accidents to any authorized representative of deceased or badly injured passenger or crewmember.

Response to both 66 and 67.--In 1981, a petition for rulemaking was submitted to the Board in which it proposed, inter alia, that the prohibition against parties being represented by anyone who also represents claimants and insurers be removed and that "observer" status be given to representatives of deceased or seriously injured passengers or crewmembers. The Board denied the petition, pointing out that its rules and policies with respect to parties and their representatives are based on the Congressional mandate to keep the Board's investigations free of the entanglement of civil litigation. Nothing has developed since that time, or was brought forward at the Symposium, which would give the Board reason to change its policy. Consequently, it does not believe that a public hearing or conference as proposed is warranted.

The Board is not authorized to keep witness statements confidential since they do not come within any of the exemptions to the Freedom of Information Act (FOIA). Moreover, as a matter of policy, taking information on a confidential basis would be contrary to the Board's policy of operating openly and sharing all information with the parties. There also might be problems with testing the reliability of information conditioned on confidentiality.

We believe that allowing the parties to review the draft analyses of the staff would jeopardize the Board's ability to apply Exemption 5 to the FOIA, which extends to intra-agency, predecisional written opinions. Release of such material to the parties could be taken as a waiver by the Board of Exemption 5. (See Recommendation 1.)

68. Recommendation.--Coordinate with the American Bar Association's Committee on Aviation and Space Law in matters implicit above; also, develop a feedback loop through them to provide the Board with results of investigations on given cases subsequent to the Board's efforts.

Response.--We do not believe it is necessary to establish or maintain any type of coordinated arrangement with organizations such as the American Bar Association for the purpose of receiving additional information regarding accidents based on the results of litigation. The Board's rules (Section 845.51) specifically provide its investigations are never officially closed but are kept open for the submission of new and pertinent evidence by any interested person. The rules also allow interested persons to request the Board to reconsider or modify its determination of probable cause. These procedures provide ample opportunity for interested persons to bring to the Board's attention information which is developed subsequent to the Board's investigation.

APPENDIX A

STATEMENT OF REPRESENTATIVE OF PARTY
TO NTSB INVESTIGATION

Aircraft Identification:

Registration Number_____

Make and Model_____

Location_____

Date_____

The undersigned_____, does hereby acknowledge that I am participating in the above referenced aircraft accident investigation on behalf of_____, for the purpose of providing technical assistance to the Safety Board.

I have read the attached copy of 49 CFR Part 831 and have familiarized myself with 49 CFR §831.9, which governs participation in NTSB investigations and agree to abide by the provisions of this regulation.

I understand that a party representative to an investigation may not be a person who also represents claimants or insurers. By placing my signature below I represent that my participation in this investigation is not on behalf of either claimants or insurers and that it is not for purposes of preparing for litigation.

_____
Signature

_____
Date

APPENDIX B

INFORMATION FOR THE GUIDANCE OF THE PARTIES TO THE INVESTIGATION OF AIRCRAFT ACCIDENTS

1. Responsibilities of the Board and Designated Parties to the Investigation

To preclude any misunderstanding concerning the responsibilities of the National Transportation Safety Board and the Federal Aviation Administration, you are referred to Title VII of the Federal Aviation Act of 1958, as amended, which sets forth the responsibilities for the investigation of aircraft accidents and Transportation Safety Act of 1974, which sets forth duties of the Board.

The National Transportation Safety Board is charged by Congress in accordance with Title VII of this Act with the responsibility of investigating civil aircraft accidents and to report the facts, conditions, and circumstances relating to each accident and probable cause thereof.

Section 701(g) of the Act states, "In order to assure the proper discharge by the Secretary of Transportation of his duties and responsibilities, the Board shall provide for the appropriate participation of the Secretary of Transportation and his representatives in any investigations conducted by the Board under this Title: Provided, that the Secretary of Transportation or his representatives shall not participate in determination of probable cause by the Board under this Title." The Board is providing appropriate participation for the Federal Aviation Administration.

2. Role of Parties to the Investigation

The purpose of permitting the participation of organizations is to assist the Board in developing a complete factual record. It likewise enables responsible safety officials whose product or services might be involved to have immediate access to facts regarding the accident from which they may initiate preventive and/or corrective action. You will participate initially during the field phase of the investigation as Parties to the Investigation. Later you may be designated as a Party to the Hearing, providing you meet the Board's requirements. All persons participating in this investigation must be in a position to contribute specific factual information or skills which would not otherwise be supplied. No participating organization will be permitted to be represented by a person whose interests lie beyond the safety objective of the accident investigation.

3. Public Hearing

Should circumstances dictate that a public hearing be held in conjunction with this accident, you will be notified. Public hearings are conducted in accordance with Part 845 of the Board's Rules of Practice in Aircraft Accident Inquiries. Subsequent to the hearing, a formal report will be prepared for public release which will include the pertinent findings and probable cause.

4. Recovery and Security of Wreckage

For the purposes of its investigation, the National Transportation Safety Board requires only the recovery of certain portions of the aircraft wreckage and protection of the accident site from interference by unauthorized parties. The Board cannot assume responsibility for the recovery of bodies, crowd control for purposes of public safety, the recovery and removal of wreckage that may constitute a public danger or nuisance, or normal police, fire, and rescue services. Should special and highly unusual circumstances arise in this area, consultations with appropriate officials will be considered.

5. Handling of Accident Information

The flow and dissemination of information will, in essence, follow this pattern: No one will withhold information. All information obtained by group members will be brought to the attention of their respective group chairman. All information ascertained during the investigation by the various groups will be passed to the Investigator in Charge by the group chairman. Each participating party will designate a coordinator (Spokesman) for their organization. Group members may pass factual information to their respective coordinators after this information has been made known to their group chairman. All of the factual information and developments of the investigation that are made known to the Investigator in Charge will be passed on to each of the coordinators. Coordinators may relay information to their respective organizations provided the information is factual and in its right perspective. This information should be transmitted on a "need to know" basis for purposes of prevention, remedial action, or other similar reasons. The coordinators will keep the Investigator in Charge apprised of information so relayed. Common sense and good judgment must predominate in this matter.

6. Dissemination of Public Information

Copies of Part 801, the National Transportation Safety Board's Procedural Regulations regarding disclosure of aircraft accident information are available here for your guidance in this matter.

Contacts with news media will be made by the Member of the National Transportation Safety Board and the Office of Public Affairs of the National Transportation Safety Board. If neither a Board Member nor a Representative of the Office of Public Affairs is available such contacts will be by the Investigator in Charge.

The guiding informational policy of the Board may be summarized by stating that:

> The Board is a Public Agency engaged in the public's business and supported by public funds. The work we do in the business of safety is open for public review; the Act under which we operate makes this mandatory. Today the Safety Board believes that briefing newsmen factually during the on-site investigation of an aircraft accident should be a normal operational part of that investigation.

7. Assignment and Duties of Group Members

We will assign and organize the various investigating groups. As we do so, please keep in mind that those selected as group members must be prepared to remain with the investigation until completion or until released by the group chairman and the Investigator in Charge.

It should be reemphasized that under the direction of the NTSB Group Chairman, one set of group notes will be developed; each group member will have in his possession a copy of such group notes prior to his release from the working group to which he was assigned. Each group member will have participated in a complete review of the group notes for technical accuracy and adequacy of the scope of the investigation in his particular area of technical expertise. The group chairman will obtain each group member's signature signifying that the group member has reviewed the notes and that any existing discrepancies reflected in these notes have either been corrected or resolved. Courtesy copies of group chairman's final reports will be provided to the participating group members.

8. Safety Precautions During Accident Investigation

Access to the wreckage site may be hazardous because of terrain and climatic conditions. Persons and equipment involved in the recovery, examination and documentation of wreckage may be exposed to considerable physical exertion, hazards posed by flammable and toxic fluids and likelihood of injury from jagged metal or falling objects. We urge everyone to exercise good judgment, utilize available protective devices, and use extreme caution when working in the wreckage agea. Do not exceed your physical limitations.

In addition, before anyone can enter the accident site, we must determine if hazardous materials were on board the aircraft. In the event hazardous materials were on board, we must determine the type of material and what actions must be taken to either remove the material or to reduce the risk of contamination or injury. Once we have determined that it is reasonably safe to enter the accident site, work at the site will be permitted.

The Board will not assume responsibility for any personal injuries incurred during the course of an investigation by any representative of any organization participating in the investigation or by an authorized observer for such organizations.

9. Signing of Attendance Roster

An attendance roster is being circulated - Please ensure that you have signed this roster prior to leaving this room. Please include both local and home office phone contacts. Your signature on the attendance roster of this organizational meeting will signify that you have read, understood, and agree to adhere to the guidelines set forth in this information sheet.

If you have questions regarding your role and responsibility in the conduct of this investigation, please consult the Investigator in Charge.

10. OBSERVERS AND ACCREDITED REPRESENTATIVES

The Investigator in Charge may designate properly accredited members of aeronautical organizations, current operators of like equipment, designated military personnel or representatives of a foreign government, as observers to the investigation. Personnel so accepted will be on the headquarters staff and will be given factual information on a "need to know basis." The restrictions outlined in Section 5., "Handling of Accident Information," applies to all observers.

Although observers may be authorized attendance to the initial organization and final "wind up" meetings, they will not be authorized to attend any progress meeting which the IIC might convene. The observers will be given factual information by the IIC. The accredited Representatives of a foreign government will be afforded the courtesies and rights as outlined in Annex 13 of ICAO.

Persons not qualified in the above categories shall not be granted observer status during the investigation phase of the inquiry. This restriction does not apply to Congressional Aides or other government agencies with a "need to know."

11. PARTY RECOMMENDATIONS AS TO FINDINGS AND CONCLUSIONS

Any party to this accident investigation may submit to the Safety Board written recommendations as to the proper findings and conclusions to be drawn from the evidence produced during the course of this accident investigation (see Safety Board rul 49 CFR 831.12). The Safety Board believes that, after the completion of the investigative activities relating to the accident and before the Board has made its determination of probable cause, it is the responsibility of each party to the investigation to make known to the Board its interpretation of the findings and conclusions to be drawn from the evidence relating to the accident. These written submissions should also be served on the other parties to the investigation.

APPENDIX C

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 13, 1982

Forwarded to:
Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-82-62 and -63

On July 9, 1982, a Pan American Boeing 727 (Flight 759) crashed into a residential area in Kenner, Louisiana, killing 145 persons on board the aircraft and 8 persons on the ground. The Safety Board's examination of the United Control Corporation (Sundstrand) V-557 cockpit voice recorder (CVR) from the aircraft has disclosed that the recording was of such poor quality that a complete readout may not be possible. The tape was in excellent physical condition, exhibiting no apparent fire damage or tearing. The Safety Board concludes that the poor quality of the tape is entirely a result of the recording process. The signal output on the cockpit area microphone (CAM) channel was below the minimum scale reading on the playback recorder's VU meter; that is, signal levels were commensurate with the equipment noise level. There were extraneous tones on the tape which were generated electronically in the recording system, the recording was distorted, and there were background conversations which apparently came from the machine's failure to erase previous conversation on the tape sufficiently. Fluctuations in tape speed (flutter and wow) were measured at 3.5 percent, nearly double the permissible value.

A number of electronic enhancement techniques have been used in an attempt to improve the quality of the CVR output; although these have helped to raise the signal-to-noise ratio somewhat, the signal is still far from clear.

On September 22, 1981, an Air Florida Airlines, Inc., DC-10-30CF sustained an uncontained failure of its right underwing engine (No. 3) during the takeoff roll at Miami International Airport, Miami, Florida. The engine failed at 90 knots indicated airspeed; the pilot rejected the takeoff and stopped the aircraft safely. 1/ During its investigation of the accident, the Safety Board was not able to read the V-557 CVR from the aircraft because the recording was distorted and the tape drive exhibited extremely poor speed control. Hence, no information at all could be obtained from the tape.

1/ For more detailed information read Aircraft Accident Report—"Air Florida Airlines, Inc., McDonnell-Douglas, Inc., DC-10-30CF, N101TV, Miami International Airport, Miami, Florida, September 22, 1981" (NTSB-AAR-82-3).

On February 16, 1982, a Reeve Aleutian Airways YS-11 crash landed on the ice in the Naknek River at King Salmon, Alaska. 2/ The Safety Board's investigation has found that the model V-557 CVR tape from this aircraft exhibited variations in tape speeds and a poor signal-to-noise ratio. The unstable tape speed made a frequency analysis of the engine sounds and air traffic control (ATC)/CVR time correlation impossible.

The Federal Aviation Administration (FAA) addressed similar problems with this recorder in 1978 in response to Safety Board Recommendations A-78-21 and -22, issued on April 13, 1978, which asked the FAA to "review the adequacy of current cockpit voice recorder preflight testing procedures to assure satisfactory system operation" and to "review the reliability of cockpit voice recorder units to assure that the mean time between failure is not excessive." The FAA replied on June 19, 1978, that it had "directed principal inspectors to reevaluate their assigned operators' CVR testing procedures to assure that the CVR testing procedures are satisfactory." FAA inspectors "were also directed to stress the need for operators to follow the CVR manufacturers' procedures and maintenance schedules. . . ." As a result of corrective actions in CVR maintenance programs, the FAA stated that it expected a substantially improved mean time between failures.

The V-557 recorder has a further history of problems. On August 22, 1967, the Safety Board issued recommendation SB-1-90 which called for review of United Control V-557 voice recorder "installation approvals granted to the operators. . . in order to ascertain that the CVR equipment as installed, meets the purpose for which it was designed."

This recommendation was made because a 1967 accident investigation "revealed an instance of cockpit voice recorder inadequacy which is the latest in a series of occurrences . . .the problem centers around the cockpit area microphone (CAM) channel on the United Control Corporation model V-557 voice recorders. Since December 15, 1966, our technicians have examined 15 [V-557] CVR units manufactured by this company." Nine of the 15 V-557's "evidenced either very weak or almost completely unintelligible CAM channels."

The FAA responded on March 25, 1968, that it was reviewing the "unsatisfactory installations" so that corrective action could be taken. Also, the manufacturer established a program to investigate "the advantages of incorporating an automatic gain control circuit to compensate for variables in the installations."

The Safety Board is concerned that the degraded quality of the recordings that it has found in recent investigations indicates that the maintenance practices for the model V-557 CVR have again degraded and that valuable accident information will continue to be lost in accidents involving aircraft equipped with this model CVR. Since the model V-557 is no longer being manufactured, the general population currently in the fleet is aging and in need of more frequent maintenance and repair. About 18 U.S. carriers are using these recorders, and there are an estimated 2,000 units either installed in various aircraft or available as spares.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

2/ Investigation in progress.

Initiate a program involving all U.S. operators using United Control Corporation (Sundstrand) V-557 cockpit voice recorders to randomly check a representative sample of these recorders in operational use to assure that they are operating within design specifications. If this inspection reveals significant problems with acceptability of recorded data, require the necessary changes in the carriers' maintenance programs to assure continued airworthiness of these recorders. (Class I, Urgent Action) (A-82-62)

After a specified period of not more than 2 years, require the removal of all United Control Corporation (Sundstrand) V-557 cockpit voice recorders and installation of suitable replacements. (Class II, Priority Action) (A-82-63)

BURNETT, Chairman, GOLDMAN, Vice Chairman, McADAMS, BURSLEY, and ENGEN, Members, concurred in these recommendations.

By Jim Burnett
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 13, 1982

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-82-64 through -67

On July 9, 1982, a Pan American Boeing 727 (flight 759) crashed into a residential area in Kenner, Louisiana, killing 145 persons on board the aircraft and 8 persons on the ground. The Safety Board's preliminary investigation indicates that wind shear may have been a factor. Analysis of the aircraft performance in this accident, as in all other air carrier accidents, depends heavily on the information received from the flight data recorder (FDR). In this case, the oscillographic, or foil, FDR carried on the accident aircraft lacks a number of basic and important parameters such as pitch and roll attitude, engine thrust, airplane configuration, and control positions -- all of which are necessary to determine the extent to which wind shear may have affected aircraft performance. In addition, the recorder itself is technologically obsolete. The limitations in the quality and quantity of data obtained from foil recorders is a matter of record. In addition, the mechanical complexity of this type recorder requires costly and frequent maintenance to ensure proper operation.

The inadequacies of the foil recorder were also brought to light in the Air Florida, Inc. Boeing-737 accident at Washington National Airport, January 13, 1982. A significant timing disparity between the CVR and FDR was eventually traced to a faulty control spring assembly after months of investigative work by the Safety Board and the recorder manufacturer. The lack of engine, attitude, and acceleration data lengthened the investigative process considerably by necessitating a costly and lengthy simulator study.

In general, the foil recorder requires a great deal of time-consuming interpretation to convert the scribed analog information for only four parameters to engineering units versus time. Recorder manufacturers have recently introduced cost-effective digital recorders to replace the foil recorders, thus making practical the installation and use of digital recorders in all aircraft currently requiring a recorder.

Two of the three domestic oscillographic recorder manufacturers are now marketing second generation digital recorders that can replace the foil recorders without an aircraft modification. The third manufacturer is currently developing a similar recorder. These new recorders have the capability of also operating in aircraft equipped with first generation digital recording systems, thus allowing air carriers operating aircraft certificated before and after September 30, 1969, the initial date when digital recorders were required, to use the same recorder for the entire fleet, an option that is impossible with a mixture of the oscillographic and first-generation digital recorders.

The modern digital recorder requires much less maintenance than its aged foil counterpart and does not require the replacement of the expensive foil recording medium every 250 to 800 hours, depending on the model. At least six domestic air carrier operators have recognized the benefits of the digital replacement recorders. All six are currently operating a number of these recorders and two have plans to convert their entire fleets.

The international aviation community has long recognized the benefits of digital recorders. Canada, Australia, Portugal, Greece, and Italy are some of the countries now operating digital recorders on aircraft certificated before September 30, 1969. The United Kingdom requires all new or second-hand aircraft brought into registration to be equipped with digital recorders. The Civil Aviation Authority, in a letter to operators dated December 11, 1980, has ordered that "it will no longer be prepared to accept foil or frequency modulated recorders as satisfying the requirements of scale P 1/ for aircraft, new or second hand, to be first brought onto UK register after the 1st July 1981."

The five-parameter set was predicated upon the assumption that aircraft certificated before September 30, 1969, would soon reach the end of their service lives. History has now clearly indicated that this assumption was not valid. New series aircraft that will incorporate new technologies such as digital cockpits are now being considered for manufacture under the old-type certificates. The Boeing Company plans to begin delivery in November 1984 of its newly announced 737-300 series aircraft with such innovations as laser-gyro inertial reference equipment and the digital cockpit which will incorporate some features of the -757 and -767, but with a five-parameter recording system. The Safety Board has noted that significant modifications are being planned for the design of this previously certificated aircraft with no regard at all for a modern flight data recording system except as a customer option.

The installation of new engines on the DC-8 aircraft and the proposed change of the B-727 from a 3-engine to a 2-engine aircraft will substantially increase expected service lives. It is also clear that the industry is experiencing a growing acceptance of the practice of installing updated engines in old airframes so that eventually other older aircraft may have their service lines significantly extended. It is our understanding that both the new series and aircraft with updated engines will be fitted with the old five-parameter recording system, even though the engineering work for the expanded parameter system has already been done for European customers. Therefore, if current standards are maintained, we can expect to see 1950's flight recorders well into 21st century aircraft.

Although aircraft certificated after September 30, 1969, are required to record more than five parameters, the current list of required parameters is in serious need of updating. The Safety Board expressed its concern in this area in 1974 when it issued Safety Recommendations A-74-15 through -17. All three recommendations were eventually rejected by the Federal Aviation Administration and classified by the Safety Board as "Closed—Unacceptable Action." Since then we have reexamined our proposed list of parameters in light of subsequent accident investigations and our renewed emphasis on human performance. We have concluded that the passage of time has not diminished the need for more information but, in fact, has strengthened it. The Safety Board is prompted once again to reaffirm the necessity of expanding flight data recording system capability so that the information in Table I can be determined as a function of time.

1/ Scale P is the minimum parameter list for United Kingdom registered aircraft certificated before September 1969; the following data, "by reference to a time-scale," are required to be recorded: indicated airspeed, indicated altitude, vertical acceleration, magnetic heading, pitch and roll attitudes, engine power, and flap position.

The continuing evolution of modern aircraft has placed an added emphasis on the capabilities and limitations of the human being in the overall man-machine-environment system. The techniques of aircraft accident investigation must also evolve if investigation is to remain an effective means of accident prevention.

Digital avionics, introduced into the cockpit in recent years, are a prime example of an innovation that is having a dramatic effect on the manner in which postaccident documentation is conducted. As programmed electronic chips with no moving parts replace the functions of rods, cables, dials, and gears, clues such as impact marks on displays or frequency settings for navigation and communication receivers will no longer be available. Thus, the flight recorder is the only viable means of retaining this vital information. Such crucial data should be earmarked early in the design process for storage by the flight recorder system.

Airframe manufacturers have demonstrated their awareness of the need to record additional information on flight recorders. McDonnell-Douglas is offering a list of parameters for its DC-9-80 that goes well beyond what is required by the current regulation. A member of the Boeing accident investigation staff has recently introduced a proposal to develop and certify a video tape recording system that would be used to record the cockpit environment for accident investigation purposes. This innovative approach stems directly from his concern over the availability of crucial information following an accident involving the new generation of large turbojet aircraft that will use cathode ray tubes (CRT) as the primary source of flight and engine information.

The Safety Board also notes that the use of sophisticated rotorcraft is expanding, both in the United States and worldwide. Major airlines have begun introducing helicopter shuttle services between airports and downtown locations. Again, the continuing evolution of modern rotorcraft utilizing new materials and displays, and in terms of human performance considerations, requires that the same measure of safety apply to persons traveling in large rotorcraft as to those traveling in large airplanes. The time has come to acknowledge that safety is served by requiring digital recorders on these aircraft. Hence, systems capable of recording information so that the items in Table II can be determined as a function of time should be installed on rotorcraft operating under 14 CFR 127.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 121.343 so that, after a specified date, all turbojet aircraft manufactured before that date and type-certificated before September 30, 1969, be required to have installed a suitable digital recorder system capable of recording data from which the minimum following information may be determined as a function of time within the ranges, accuracies, and recording intervals specified in Table I--altitude, airspeed, heading, radio transmitter keying, pitch attitude, roll attitude, vertical acceleration, longitudinal acceleration, stabilizer trim position, engine thrust, and pitch control position. (Class II, Priority Action) (A-82-64)

At an early date and pending the effective date of the recommended amendment of 14 CFR 121.343 to require installation of digital flight data recorder systems capable of recording more extensive parameters, require that operators of all aircraft equipped with foil flight data recorders be required to replace the foil recorder with a compatible digital recorder. (Class I, Urgent Action) (A-82-65)

Amend 14 CFR 121.343 so that, after a specified date, all aircraft manufactured after that date, regardless of the date of original type certificate, be equipped with one or more approved flight recorders that record data from which the information listed in Table I can be determined as a function of time. For newly type-certificated aircraft, any dedicated parameter which may be necessary because of unique features of the specific aircraft configuration and the type design should also be required. (Class II, Priority Action) (A-82-66)

Amend 14 CFR 127, Subpart H, to require that all rotorcraft manufactured after a specified date, regardless of the date of original type certificate, be equipped with one or more approved flight recorders that record data from which the information listed in Table II can be determined as a function of time. For newly type-certificated rotorcraft, any dedicated parameter which may be necessary because of unique features of the specific configuration and type design should also be required. (Class II, Priority Action) (A-82-67)

BURNETT, Chairman, GOLDMAN, Vice Chairman, McADAMS, BURSLEY, and ENGEN, Members, concurred in these recommendations.

By: Jim Burnett
Chairman

TABLE I

PARAMETER LIST (14 CFR 121)

PARAMETERS	RANGE	ACCURACY (SENSOR INPUT TO DFDR READOUT)	SAMPLING INTER (PER SECOND)
Time (GMT)	24 Hrs	±0.125% Per Hour	0.25 (1 per 4 secon
Altitude	-1,000 ft to max certificated altitude of aircraft	+100 to +700 ft (See Table I, TSO-C51a)	1
Airspeed	50 KIAS to Vso, and Vso to 1.2 V_D	±5% ±3%	1
Heading	360°	±2°	1
Normal Acceleration (Vertical)	-3g to +6g	±1% of max range excluding datum error of ±5%	8
Pitch Attitude	±75°	±2°	1
Roll Attitude	±180°	±2°	1
Radio Transmitter Keying	On-Off (Discrete)		1
Thrust/Power On Each Engine	Full Range Forward	±2%	1 (per engine)
Trailing Edge Flap Or Cockpit Control Selection	Full Range Or Each Discrete Ppsition	±3° Or As Pilot's Indicator	0.5
Leading Edge Flap Or Cockpit Control Selection	Full Range Or Each Discrete Position	±3° Or As Pilot's Indicator	0.5
Thrust Reverser Position	Stowed, In Transit, And Reverse (Discrete)		1 (per engine)
Ground Spoiler/Speed Brake Selection	Full Range Or Each Discrete Position	±2% Unless Higher Accuracy Uniquely Required	1
Marker Beacon Passage	Discrete		1

PARAMETERS	RANGE	ACCURACY (SENSOR INPUT TO DFDR READOUT)	SAMPLING INTERV (PER SECOND)
Longitudinal Acceleration	±1g	±1.5% Max Range Excluding Datum Error of ±5%	4
Pilot Input And Surface Position-Primary Controls (Pitch, Roll, Yaw)	Full Range	±2° Unless Higher Accuracy Uniquely Required	1
Lateral Acceleration	±1g	±1.5% Max Range Excluding Datum Error of ±5%	4
Pitch Trim Position	Full Range	±3% Unless Higher Accuracy Uniquely Required	1
Glideslope Deviation	±400 Microamps	±3%	1
Localizer Deviation	±400 Microamps	±3%	1
AFCS Mode And Engagement Status	Discrete (5 Bits Necessary)		1
Radio Altitude	-20 ft to 2,500 ft	±2 Ft Or ±3% Whichever Is Greater Below 500 Ft And ±5% Above 500 Ft	1
Master Warning	Discrete		1
Nav 1 and 2 Frequency Selection	Full Range	As Installed	0.25
DME 1 and 2 Distance	0-200 NM;	As Installed	0.25
Main Gear Squat Switch Status	Discrete		1
Angle of Attack (If Recorded Directly)	As Installed	As Installed	2
Outside Air Temperature	-90°C to +50°C	±2°C	0.5

TABLE I (3)

PARAMETERS	RANGE	ACCURACY (SENSOR INPUT TO DFDR READOUT	SAMPLING INTERVAL (PER SECOND)
Hydraulics, Each System Low Pressure	Discrete		0.5
Groundspeed	As Installed	Most Accurate System Installed (INS Equipped Aircraft Only)	1

TABLE II

PARAMETER LIST (14 CFR 127)

PARAMETERS	RANGE	ACCURACY (SENSOR INPUT TO DFDR READOUT)	SAMPLING INTERVAL (PER SECOND)
Time (GMT)	24 hrs	±0.125% per hr	0.25 (1 per 4 seconds)
Pressure Altitude	-1,000 ft to max certificated altitude of aircraft	+100 to +700 ft (See Table 1, TSO-C51a)	1
Airspeed	As the installed measuring system	±3%	1
Heading	360°	±2°	1
Normal Acceleration (Vertical)	-3g to +6g	±1% of max range excluding datum error of ±5%	8
Pitch Attitude	±75°	±2°	2
Roll Attitude	±180°	±2°	2
Radio Transmitter Keying	On-off (Discrete)		1
Power on Each Engine: Free Power Turbine Speed and Engine Torque	0-130% (Power Turbine Speed) Full range (Torque)	±2%	1 speed 1 torque (per engine)
Main Rotor Speed	0-130%	±2%	2
Altitude Rate	±6,000 ft/min	As installed	2
Pilot Input - Primary Controls (Collective, Longitudinal Cyclic, Lateral Cyclic, Pedal)	Full range	±3%	2
Flight Control Hydraulic Pressure Low	Discrete, each circuit		1

PARAMETERS	RANGE	ACCURACY (SENSOR INPUT TO DFDR READOUT)	SAMPLING INTERVAL (PER SECOND)
Flight Control Hydraulic Pressure Selector Switch Position, 1st and 2nd Stage	Discrete		1
AFCS Mode and Engagement Status	Discrete (5 bits necessary)		1
Stability Augmentation System Engage	Discrete		1
SAS Fault Status	Discrete		0.25
Main Gearbox Pressure Low	As installed	As installed	0.25
Main Gearbox Temperature High	As installed	As installed	0.5
Controllable Stabilator Position	Full range	±3%	2
Longitudinal Acceleration	±1g	±1.5% max range excluding datum error of ±5%	4
Lateral Acceleration	±1g	±1.5% max range excluding datum error of ±5%	4
Master Warning	Discrete		1
Nav 1 and 2 Frequency Selection	Full range	As installed	0.25
Outside Air Temperature	-90°C to +50°C	±2°C	0.5

APPENDIX D

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

MAR 24 1983

Dear Mr. Helms:

The National Transportation Safety Board has reviewed the implications to the Board of the Federal Aviation Administration's (FAA) recently adopted policy governing the regulation of the operation of ultralight vehicles. A copy of the policy statement which has been adopted as a result of the Safety Board's review is enclosed.

Because of the interest and growth in powered ultralight activity, the Safety Board agrees that immediate action by the FAA to assure its safe development, to reduce potential conflict with other airspace users, and to provide protection to persons and property on the ground was necessary. We believe that privately sponsored education and training programs should be able to guide the safe growth of powered ultralight flying and that a hands-off policy should be attempted on a trial basis in a manner paralleling that currently in place for the unpowered hang glider community. There have been announcements by the Aircraft Owners and Pilots Association, acting through its Air Safety Foundation, and the Experimental Aircraft Association that they will take the necessary steps to meet the education and training needs of the powered ultralight community. There is every indication that such activities can be effective in promoting safety. It also appears that the Powered Ultralight Manufacturers Association has the capability to formulate reasonable and safe manufacturing and quality control standards within its unique community.

However, the Safety Board believes that there is a demonstrated need for a nationally recognized and institutionalized accident reporting system. Such a system is essential to the early identification of safety problems which the ultralight community might encounter. We believe that in the spirit of 14 CFR Part 103, the associations fostering development of ultralight vehicle aviation should voluntarily develop an accident reporting system. At a minimum, the system should be standardized as to be compatible with the provision of the Board's procedural regulations, 49 CFR 830.2, .5 and .6. Clearly, it is in the ultralight community's best interest to move forward with the development of an accident reporting system as a means of fostering safety. We would be pleased to assist, in conjunction with the FAA, in the development of the accident reporting system since we believe that one important objective should be that the system have a data base fully compatible with all safety data needs.

We reviewed the need to investigate ultralight vehicle accidents and incidents before the issuance of 14 CFR Part 103 and concluded that we would not be able to investigate all such accidents because of our limited resources. However, the Safety Board is concerned about the impact that ultralight vehicle operations may have on public safety, and the Board has concluded that it will selectively investigate these accidents in addition to those already falling within standard investigation criteria, such as midair collision, in order to establish an accident base, to determine the effectiveness of 14 CFR Part 103, and to recommend necessary safety improvements in this field of aviation in its early stages of development. The Board will investigate all fatal powered ultralight vehicle accidents and other selected accidents which may involve significant safety issues. The Safety Board looks forward to your cooperation and that of the ultralight industry in a common effort to promote safety goals appropriate to this form of sport aviation.

Respectfully yours,

ORIGINAL SIGNED BY
JIM BURNETT

Jim Burnett
Chairman

NTSB POLICY REGARDING ULTRALIGHT VEHICLES

Ultralight vehicle operators and manufacturers are governed by the recently adopted Federal Aviation Regulation (FAR) 14 CFR Part 103, which defines ultralights for Federal regulatory purposes and establishes the circumstances in which they may be operated without coming under detailed Federal regulation. Currently, operators of these vehicles are not required to be certificated or to have aviation flight training. Ultralights are not required to be certificated or to be registered. To date, data concerning accidents have not been collected in a concerted manner which will permit assessment and effective accident prevention efforts. Consequently, the completeness of the data relating to fatal and nonfatal accidents varies depending on the source. Accident estimates for 1981 are 141 with 16 being fatal, and for 1982, 223 with 23 being fatal; there is no clear distinction in the data between powered and unpowered vehicle operations. The Federal Aviation Administration (FAA) does not contemplate establishing a program for collecting data on accidents involving ultralights.

The FAA determined that it would not promulgate detailed Federal regulations regarding ultralight operator certification, vehicle certification, or vehicle registration, but rather that it would treat ultralight operations as a part of the larger community of sport aviation, and that within this broad category, it would encourage the ultralight community to develop its own programs and to police itself so long as its operations did not come into conflict with other civil aircraft, and persons and property on the ground. The FAA's intent is to afford the ultralight community the opportunity to take private sector action to develop safety programs relating to ultralight pilot certification and vehicle certification and to establish a private registration system. Should the ultralight community fail to develop and implement programs in these areas, the FAA is prepared to undertake detailed regulatory action.

Early on, the Experimental Aircraft Association (EAA) initiated an ultralight vehicle program by forming a separate association for this activity. The program is aimed at educating the ultralight pilot regarding flight regulations and FAR Part 91, and at developing other educational materials as well. It also has established a voluntary incident and accident reporting system within the ultralight association. The Aircraft Owners and Pilots Association (AOPA) has undertaken a four-point ultralight program which covers airman certification and accident reporting. AOPA has organized a special Ultralight Division which will concern itself with the needs and interests of the ultralight community in the development of safety programs. AOPA is in the process also of designing an accident reporting system for powered and unpowered ultralights. With this accident reporting system, AOPA expects to be able to study accident trends and to disseminate safety information regarding specific types of ultralight vehicles.

The Powered Ultralight Manufacturers Association (PUMA) recently has taken steps to change its organizational character to include professional as well as promotional activity. The association appears to be prepared to accept part of the responsibility for airworthiness standards which was left to the industry by the regulations for ultralights contained in FAR Part 103. PUMA is drafting airworthiness standards for powered ultralight vehicles, and plans to publish and to distribute to the ultralight community a monthly newsletter which will discuss ultralight accident data.

The Safety Board believes that the ultralight community, through properly directed efforts, can provide for its safety needs, and it supports the private development of a safety program and accident reporting network which will permit the sport to improve its safety record as it grows. Although the Safety Board supports these foregoing industry programs, it is concerned about the impact this industry will have on public safety. In order to assess the effectiveness of FAR Part 103, the Board believes it to be necessary to investigate a limited number of ultralight vehicle accidents during the early development stages of this industry.

Therefore, the Safety Board will investigate all fatal powered ultralight vehicle accidents and other selected accidents which may involve significant safety issues. The Board also will investigate ultralight vehicle accidents impinging on other civil aircraft operations or on persons and property on the ground, in accordance with its existing selection criteria for accidents and incidents. Finally, the Board is prepared to provide technical assistance in the formulation of a privately maintained accident reporting system. As a reporting network is developed, the Safety Board will review accident data and the safety efforts of the community periodically in order to keep abreast of any emerging safety problems disclosed by those accidents which it will not be investigating. The Safety Board urges the FAA similarly to keep abreast of accident data and the safety efforts of the ultralight community in order to be able to act promptly to impose regulatory controls as necessary.

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