UNITED STATES OF AMERICA

NATIONAL TRANSPORTATION SAFETY BOARD

OFFICE OF ADMINISTRATIVE LAW JUDGES

* *
In the Matter of the Investigation of *
Southwest Airlines Co., Flight 1248, * Docket No. DCA-06-MA-009
Boeing 737-7H4, N471WN, *
Chicago, Illinois, December 8, 2005 *
* *

National Transportation Safety Board
490 L'Enfant Plaza East, S.W.
Washington, D.C. 20694

Tuesday,
June 20, 2006

The above-entitled matter came on for hearing, pursuant to Notice, at 9:00 a.m.

BEFORE: MARK V. ROSENKER, Chairman

BOB BENZON, Hearing Officer, Investigator-in-Charge, Major Investigations Division

DR. VERNON S. ELLINGSTAD, Director, Office of Research and Engineering

JOHN CLARK, Director, Office of Aviation Safety

APPEARANCES:

Technical Panel:

CAPT. DAVE KIRCHGESSNER
DR. KATHERINE LEMOS
DR. KEVIN RENZE
MARK GEORGE

On behalf of Federal Aviation Administration:

STEVE WALLACE, Director, Office of Accident Investigations

MARK TOMICICH, Office of the Chief Counsel

DON STIMSON, Performance Engineer, Transport Airplane Directorate

JERRY OSTRONIC, Flight Standards Service

DAN DIGGINS, Team Leader, Office of Investigation

BOBBY HEDLUND

TONY JAMES

On behalf of Southwest Airlines:

TIM LOGAN, Director, Flight Operations

CAPT. TED LAWSON, Manager, Flight Safety

JEFF GRENIER, Manager, Flight Safety Response

DEBBY ACKERMAN, General Counsel

CAPT. MARK CLAYTON, Director, Operations

DANE JACQUES, counsel

On behalf of Southwest Airlines
Pilots Association (SWAPA):

CAPT. JEFF HEFNER, Coordinator/Chief Accident Investigator

CAPT. JOHN GADZINSKI, Performance Group

CAPT. LARRY KLINE, Weather and ATC

CAPT. JIM DUFFY, Systems Group

FIRST OFFICER CHRIS PERKINS, Ops Group

CAPT. JOE EICHELKRAUT, President, Southwest Airlines Pilots Association

NICH ENOCH, counsel

On behalf of the City of Chicago:

NURIA I. FERNANDEZ, Commissioner, Department of Aviation

ALBERTO RODRIGUEZ, Chief Operations Officer Midway Airport

AL PEREZ, Assistant Commissioner for Operations Midway Airport

JAMES SCZCESNIAK, Assistant Commissioner for Planning Department of Aviation

BRANDT MADSEN, counsel to the Airport

RAMON RICCAONDOT, Aviation Planner

On behalf of Boeing Co.:

MARK SMITH, Air Safety Investigation Group
Boeing Seattle

ROBERT J. ORLOWSKI, Aerodynamic Performance
Specialist

BRUCE A. DICKERSON, Senior Manager, 737 Program

CAPT. JAMES RATLEY, Senior Technical Pilot, 737

RICHARD BREUTHAUS, Director, Air Safety Investigation

JOHN DILLOW, counsel

PAUL D. GIESNMAN

Witnesses:

ANGELO BOCCANFUSO
TOM YAGER
DAVE BENNETT
RICH MARINELLI
PAUL D. GEISMAN
WILLIAM DeGROH
ALBERTO RODRIGUEZ
DENNIS MOSSELLER
JAMES SZCZESNIAK
G. KENT THOMPSON

I N D E X

TOPIC 2: RUNWAY SAFETY AREAS AT MIDWAY AIRPORT AND OTHER AIRPORTS WITH LAND USE CONSTRAINTS

P R O C E E D I N G S

(9:00 a.m.)

CHAIRMAN ROSENKER: Good morning, ladies and gentlemen. Welcome to the National Transportation Safety Board's boardroom.

My name is Mark Rosenker. I'm the Acting Chairman of the National Transportation Safety Board, and I will be the Chairman of this Board of Inquiry.

Today we are opening a public hearing concerning the accident that occurred on December 8, 2005, in Chicago, Illinois, involving Southwest Airlines, Flight 1248.

Let me acknowledge any family members of the child who lost their lives in this accident. On behalf of the National Transportation Safety Board and my colleagues and staff, I also say on behalf of all the parties who have joined in this investigation, we wish to express our most sincere condolences for their tragic loss.

The hearing is being held for the purpose of supplementing the facts, conditions and circumstances discovered during the on scene and continuing phases of investigation. This process will assist the NTSB in determine the probable cause of the accident and in making any recommendations to prevent similar accidents from happening in the future. No determination of cause will be rendered during these proceedings.

While airline accidents are rare events, they are widely publicized and scrutinized by experts around the globe. When an accident such as this does occur, it is the responsibility of the NTSB with the assistance of the FAA and other designated parties from Government, industry and labor, to find out what happened, why it happened, and how we can prevent this unfortunate event from recurring.

The purpose of this hearing is twofold. First, the issues that will be discussed at this hearing will be technical in nature, serve to assist the Safety Board in developing additional factual information that will be analyzed for the purpose of determining probable cause of the accident. Secondly, this hearing also provides the opportunity, not only to the aviation community, but to the traveling public as well, to see a portion of the total investigative process and the dedicated efforts being put forth by investigators from many different organizations, as well as to find the cause of this tragic accident.

I want to assure you that the Safety Board will pursue every lead toward an ultimate solution to what caused this accident, but we are also here to fulfill our broader mandate, to formulate recommendations to prevent such tragedies in the future, on behalf of the millions of passengers in the United States and around the world who use this form of transportation every year.

Public hearings such as this are exercises in accountability. Accountability on the part of the Safety Board that it is a conducting a thorough and fair investigation. Accountability on the part of the FAA, that it is adequately regulating the industry. Accountability on the part of the airline, that it is operating safely. Accountability on the part of manufacturers as to the design and performance of their products. Accountability on the part of the workforce, including pilots and mechanics, that they are performing up to the high standards of professionalism expected of them.

As previously stated, these proceedings tend to become a highly technical event, but they are essential in seeking to reassure the public that everything is being done to insure the safety of the airline industry.

The purpose of this inquiry is not to determine the rights or liability of private parties, and matters dealing with such rights or liability will be excluded from these proceedings.

Over the course of this hearing, we will continue to collect information that will assist the Safety Board in its examination of safety issues arising from this accident, specifically we will concentrate on the following issues.

One, the measurement of runway friction and the methods used to relay runway friction estimates to landing flight crews.

Two, runway safety areas at Midway Airport and other airports with land use constraints.

And, three, the Boeing 737 landing data that takes into account the use of thrust reversers.

At this point, I would like to introduce the other members of the Board of Inquiry.

Mr. John Clark is the Director of the Office of Aviation Safety on my right.

Dr. Vern Ellingstad on my left is the Director of the Office of Research and Engineering, and on my far left, Mr. Robert Benzon of our Major Investigations Division. He is the Investigating Officer in charge of this investigation and will also serve as our Hearing Officer.

The Board will be assisted by a Technical Panel consisting of the following NTSB staff: Capt. David Kirchgessner, Dr. Katherine Lemos, Dr. Kevin Renze, and Mr. Mark George.

Mr. Keith Holloway and his colleagues from the Safety Board's Public Affairs Office are here to assist members of the news media.

Neither I nor any other Safety Board personnel will attempt during this hearing to analyze the testimony received nor will any attempt be made at this time to determine the probable cause of this accident. Such analysis and cause determinations will be made by the full Safety Board, after consideration of all of the evidence gathered during our investigation.

A final report on the accident reflecting the Safety Board's analysis and probably cause determinations will be considered for adoption by the full Board at a public hearing, excuse me, a public meeting here at the Safety Board's headquarters at a later date.

The Safety Board's rules provide for the designation of parties to a public hearing. In accordance with these rules, those persons, Governmental agencies, companies and associations, whose participation in the area is deemed necessary, in the public interest and whose special knowledge will contribute to the development of pertinent evidence, are designated as parties. The parties assisting the Safety Board in this hearing have been designated in accordance with these rules.

As I call the name of each party, will the designated spokesperson please give his or her name, title and affiliation for the record.

For the Federal Aviation Administration?

MR. WALLACE: Thank you, Mr. Chairman. Good morning.

CHAIRMAN ROSENKER: I cannot hear you, Mr. Wallace.

MR. WALLACE: How's that?

CHAIRMAN ROSENKER: Better. Thank you.

MR. WALLACE: Good morning, sir. Steven Wallace, Director of the Office of Accident Investigation for the Federal Aviation Administration. Would you like me, sir, to introduce my colleagues at the table?

CHAIRMAN ROSENKER: Please.

MR. WALLACE: Mr. Mark Tomicich from the Office of the Chief Counsel, Mr. Don Stimson, a performance engineer from the Transport Airplane Directorate, Mr. Jerry Ostronic from the Flight Standards Service. Mr. Ostronic and Mr. Stimson will be witnesses later in the proceedings. And Mr. Dan Diggins, team leader from the Office of Investigation. Thank you, sir.

CHAIRMAN ROSENKER: Thank you, Mr. Wallace.

For Southwest Airlines?

MR. LOGAN: Good morning, Mr. Chairman. My name is Tim Logan. I'm the Director of Flight Operations at Southwest Airlines, and with us at the table I have Ms. Debby Ackerman who is Southwest general counsel, Capt. Mark Clayton who is the Director of Operations, Mr. Jeff Grenier who is the Manager of Flight Safety Response, Capt. Ted Lawson, Manager of Flight Safety and also Dane Jacques, outside counsel. Thank you.

CHAIRMAN ROSENKER: Thank you very much.

For the Southwest Airlines Pilots Association?

CAPT. HEFNER: Good morning, Mr. Chairman. Capt. Jeff Hefner, Southwest Airlines Pilots Association -- Coordinator and Chief Accident Investigator for our pilot's Union. I'm assisted today by Capt. John Gadzinski of the

Performance Group, Nick Enoch who is our counsel, Capt. Joe Eichelkraut who is the President of the Southwest Airlines Pilots Association, Capt. Jim Duffy, Systems Group, First Officer Chris Perkins who is on the Ops Group, and Capt. Larry Kline, Weather and ATC.

CHAIRMAN ROSENKER: Thank you very much.

For the City of Chicago?

COMMISSIONER FERNANDEZ: Good morning, Mr. Chairman. Nuria Fernandez, Commissioner for the Department of Aviation, City of Chicago. I'm here with my colleagues. To my right is Brad Madsen who is the counsel to the Airport, followed by Ramon Riccaondot, our Aviation Planner. We also have Al Perez who is the Assistant Commissioner for Operations at Midway Airport, Jim Sczcesniak who is our Assistant Commissioner for Planning for the Department of Aviation and Alberto Rodriguez who is the Chief Operations Officer for Midway Airport. Thank you.

CHAIRMAN ROSENKER: Thank you.

And finally for the Boeing Commercial Airplane Company?

MR. SMITH: Good morning, Mr. Chairman. I'm Mark Smith from the Air Safety Investigation Group, at Boeing Seattle. I have with me at the table Rich Breuthaus, Director of Air Safety Investigation, Capt. Jim Ratley, Senior Technical Pilot for the 737, Bruce Dickerson, Senior Manager for our 737

Program, Mr. Bob Orlowski, Aerodynamic Performance Specialist for landing distances, and Mr. John Dillow, outside counsel.

CHAIRMAN ROSENKER: Thank you very much. Before I proceed, I would also like to recognize that one of my colleagues, Member Kitty Higgins, is here to observe the proceedings. She will be also at some time doing one of these hearings as well.

I want to thank publicly all of the private, municipal, county, state and federal agencies that have supported the Safety Board throughout the investigation.

On June 12, 2006, the Board of Inquiry held a pre-hearing conference at the Safety Board facilities. It was attended by the Safety Board's Technical Panel and representatives of the parties to this hearing. During that conference, the areas of inquiry and scope of issues to be explored at this hearing were delineated and the selection of witnesses to testify on these issues were finalized. Copies of the witness list developed at the pre-hearing conference are available in the foyer.

There are numerous exhibits that will be used in this proceeding. Copies of the exhibits may be ordered through our Public Inquiries Branch, and our phone number there, (202) 314-6551, and can be found on the Board's website at www.ntsb.gov.

The witnesses testifying at this hearing have been selected because of their ability to provide the best available information on the issues of aviation safety pertinent to this accident investigation.

The investigator in charge of the accident investigation will summarize certain facts about the accident, and the investigative activities that have taken place to date.

Following this, the first witness will be called. The witnesses will be questioned first by the Board's Technical Panel, then by the designated spokesperson for each party to the hearing, and finally by the Board of Inquiry.

As Chairman of the Board of Inquiry, I will be responsible for the conduct of the hearing. I will make all rulings on the admissibility of evidence. All such rulings will be final.

The record of the investigation, including the transcript of the hearing and all exhibits entered into the record, become part of the Safety Board's public docket on this accident and will be available for inspection at the Board's Washington Office. Anyone wishing to purchase the transcript, including parties to the investigation, should contact the Court Reporter directly.

Mr. Benzon, are you ready to summarize the investigation and enter the exhibits into the public document?

MR. BENZON: The exhibits were entered about 10 minutes ago, sir, and I'm ready to summarize.

CHAIRMAN ROSENKER: Please take the witness stand and proceed.

MR. BENZON: Will you bring up my presentation please?

On December 8, 2005, at about 19:14 Central Standard Time, Southwest Airlines Flight 1248, a Boeing 737, overran the runway, Runway 31C, at Chicago Midway Airport in Chicago, Illinois, during a landing rollout. The airplane departed the end of the runway, rolled through a blast fence, a perimeter fence, and onto a roadway. One automobile occupant was fatally injured. The airplane was substantially damaged. Instrument weather conditions prevailed at the time, and the flight was conducted under 14 C.F.R. Part 121.

The Safety Board was notified about the accident shortly after it occurred, and a team of investigators and other staff arrived on scene early the next morning. Former Board Member Engleman-Connors was the Board member on scene.

The weather at the time of the accident was not good. An approximate 200-foot ceiling existed, and the aircraft landed with an 8 to 9 knot tailwind. The temperature was 25 degrees, steady snow was falling and the runway had last been cleared about 27 minutes prior to landing. At that time, 10 percent of the runway was reported to be clear and wet while the remaining 90 percent was reported to have a trace to 1/16 inch of snow.

A pilot report from a previous landing Boeing 737 indicated that fair to poor breaking action existed.

This photograph depicts Midway Airport. Midway occupies one square mile and the landing Runway 31C is 6,522 feet long. Eyewitnesses and information from the flight data recorder indicated that Flight 1248 touched down within the normal touchdown zone at an air speed of about 125 knots. The circle indicates where the aircraft came to rest, just off airport property.

This is a close up photograph of the departure end of Runway 31C, showing the ground track of the aircraft, the metal blast fence, the instrument landing system antenna array, and the airport perimeter fence that the aircraft rolled through before it stopped in the street.

I would like to show you now an animation of the accident based on flight data recorder information, but first an explanation is in order using a couple of stills from that animation.

In the upper left-hand corner of this still, you will see crew comments and selected FDR items as they occurred during the landing. In the upper right corner, you'll see an indicator of brake pressure. A normal brake pressure for full autobrakes is 2800 psi. You'll see it quickly rise to that as the captain applied the brakes on landing. When he overrode the autobrakes, the pressure will jump to about 3,000 psi.

Now below the brake pressure indicator, you'll see a thrust reverser status indicator. In transit status will be yellow wording, in this case, tran and it will change to DEP in red, deploy, when the thrust reversers are fully deployed. Below that on the right, you'll see an engine thrust indication, that's 0 to 100 percent thrust on the engine. Below that, you'll see a little number that indicates ground speed and lastly, at the far end of the runway, you'll see the blast fence in red.

During the first run through, I'm going to try to pause the animation several times to point out pertinent items. It's always encouraging.

Okay. Normal landing approach and he's going to touch down within the touchdown zone here. Here's the touchdown. You'll note the brake pressure coming up on the upper right, going at 2800 psi, spoilers are deployed, thrust reverses are going to transit here in a second, brake pressure is now at 3,000. Both thrust reversers are deployed but the thrust is still back around 25 percent. It's increasing, and he's about to go off the paved surface. He's got full thrust reverse on now. He's down to 155 knots, 145, he strikes the blast fence, and goes into the street.

CHAIRMAN ROSENKER: Mr. Benzon, you need to clarify, you stated the speed at the end of the runway was 150 knots. It was actually 50 knots I believe.

MR. BENZON: 50 knots, of course.

CHAIRMAN ROSENKER: Not the 100.

MR. BENZON: We'll play it one more time without my comments here.

(Pause while animation plays.)

CHAIRMAN ROSENKER: Mr. Benzon, if I could ask for a clarification also. It appeared at apparently 40 miles an hour is when it struck that barrier.

MR. BENZON: Okay. I have to do a little backing up here.

The next four photographs depict the aircraft during the passenger evacuation and shortly thereafter. Passengers evacuated out the forward emergency entry door via the escape slide and through the aft right emergency escape door once a mobile stairway arrived.

This photograph shows the aircraft on the morning after the accident. Please note the pieces of blast fence and antenna components in the foreground.

Prior to the landing, the flight crew computed their landing distance using an on-board performance computer. That's a laptop computer loaded with landing data software among other programs. After being told that the runway braking conditions were fair to poor by the crew of the B737 that landed before them, they entered a fair runway friction condition into the OPC. The computer calculated that they could stop the aircraft with 560 feet of pavement in front of them. Had the crew used a poor entry into the OPC, it would have told them that they would have only 30 feet of pavement in front of them when they stopped.

The on-board performance computer stopping distance calculations take into account the slowing effect of engine thrust reverser use and the landing was also calculated to be using the autobrakes at their maximum setting.

Now to recap a bit, shortly after touchdown, the captain felt that the airplane was not decelerating properly and overrode the autobrakes with manual braking. He also stated that he had trouble lifting the reverse thrust levers. The thrust reversers were fully deployed by the First Officer 18 seconds after touchdown, and the full effect of thrust reversers was not obtained until 27 seconds after touchdown. The aircraft departed the paved surface about 7 seconds later, again at a speed of about 40 knots.

Now several aircraft systems that aid in stopping a landing aircraft were examined by the Safety Board. No anomalies could be found in the wing flaps, the ground spoilers, auto and manual brake systems, the anti-skid system or thrust reverser actuation components.

Three main safety issues emerged from the investigation and all are topics of this public hearing, and they're as follows: the accuracy of dissemination of runway friction measurements, adequacy of safety areas, and lastly, aircraft landing performance.

Specifically the runway friction measurement discussion will address the current state of the art for measuring of runway friction, the ongoing joint NASA, FAA, Transport Canada studies measuring equipment limitations, Midway Airport snow removal procedures, and the pilot's role in friction information dissemination.

Runway safety area topics will include the FAA Runway Safety Area Program, the FAA policy on runway safety area upgrading, a technical description of the Engineered Material Arresting System or EMAS, and EMAS development at Midway Airport.

Finally, concerning aircraft landing performance will be discussing the dispatch versus operational landing data, current and proposed provisions for a viable landing safety margin, findings of the FAA Safe Landing Distance Task Force, on-board performance computer use, and lastly, thrust reverser use.

Now as a result of this investigation, the Safety Board issued an urgent recommendation early on to the FAA to immediately prohibit the use of thrust reverser credit in landing calculations. We will be discussing the FAA response to this recommendation during this hearing.

Mr. Chairman, that concludes my review.

CHAIRMAN ROSENKER: Thank you, Mr. Benzon. Would you come back or are you going to be swearing in the witnesses at that point right now. We'll call the first witness. You'll be flipping back and forth, given the fact you're both a member of the Technical Panel, the IIC and the Hearing Officer. So --

MR. BENZON: Can we call the following folks forward please? Mr. Angelo Boccanfuso, Transport Canada and, sir, you'll be the first presenter. Take the seat behind the laptop there. Mr. Tom Yager from the National Aeronautics and Space Administration, Mr. Rick Marinelli from the FAA, Mr. Paul Geisman from Boeing, and Mr. Bill DeGroh from Airline Pilots Association.

CHAIRMAN ROSENKER: Consider yourself sworn in and -- excuse me, Mr. Benzon.

(Whereupon,

ANGELO BOCCANFUSO, TOM YAGER, RICK MARINELLI,

PAUL GEISMAN and BILL DeGROH

were called as witnesses, and having been first duly sworn, was examined and testified as follows:)

MR. BENZON: And, gentlemen, starting with Mr. Boccanfuso, could you just give us your name for the record and then an idea of what you do for your separate organizations.

MR. BOCCANFUSO: My name is Angelo Boccanfuso. I work with Ford Transport Canada in an agency called Transportation Development Center. The agency's role is to coordinate R&D for Transport Canada's various modes. In my particular area, we coordinate research for the Civil Aviation Branch.

MR. BENZON: Mr. Yager?

MR. YAGER: My name is Tom Yager. I work at NASA Langley Research Center in Hampton, Virginia. I've been involved since the early sixties in looking at aircraft ground handling performance, and as a consequence of that work, I've gotten into runway friction measurements and contaminated runway performance.

MR. BENZON: Mr. Marinelli?

MR. MARINELLI: Rick Marinelli, the Manager of the Airport Engineering Division at FAA Headquarters. My responsibilities include standards for the geometric design, operation, construction, maintenance of airports.

MR. BENZON: Mr. Geisman?

MR. GEISMAN: Paul Geisman. I work in Flight Operations Engineering at the Boeing Company. I am the contaminated runway airplane performance focal point for that staff.

MR. BENZON: And, Mr. DeGroh?

CAPT. DeGROH: William DeGroh.

CHAIRMAN ROSENKER: Captain, we can't hear you.

CAPT. DeGROH: How's that? There we go. My name is Bill DeGroh. I'm representing the Airline Pilots Association as the Director of Aircraft Performance Projects. I have an aerospace engineering degree and am a current line pilot.

MR. BENZON: Thank you, gentlemen.

CHAIRMAN ROSENKER: Thank you very much. I appreciate the opportunity to hear your qualifications and which provides the expertise to be able to testify for us in this case.

I understand each of you have a short presentation. Let's begin.

MR. BOCCANFUSO: Good morning, ladies and gentlemen. Before I begin, I'd just like to say that the Transportation Development Center, being an R&D organization, our mandate doesn't include writing standards or regulations. What I'll be speaking from is a purely research perspective.

The reason that Transport Canada got involved in friction research is because in Canada, we have an accident in Dryden, Ontario in 1989 whereby 23 people died in a Fokker 28.

As a result, a commission of inquiry was established. The investigation came up with 196 recommendations of which several were related to runway contamination. However, one in particular, Recommendation 44, which stated that Transport Canada find an accurate means of defining runway conditions and related to aircraft braking performance. Transport Canada's response to this was to establish a technical working group in 1996, to deal with Recommendation 44.

We began test trials in North Bay, Ontario, with the cooperation of the FAA and NASA, and as interest grew in the program, and with the increased participation, we christened the program, the Joint Winter Runway Friction Measurement Program.

The objectives of the program were to determine the relationship between measured friction and aircraft braking performance, to correlate ground friction measuring devices when operating on a contaminated surface, and finally, to establish an international methodology whereby a common indication of runway conditions can be implemented worldwide. So in essence, we were pretty much where you are about 15, 20 years ago.

In obtaining our objectives, we used the five phase approach whereby we first gathered data with ground vehicles, then with instrumented aircraft. We analyzed the data, looked at the correlation and then applied the knowledge gained leading us to verify the methodology, and our quest for a variety of contaminated surfaces, equipment and aircraft, we tested in various countries. In Canada, the U.S., Norway, Germany, Czech Republic, Japan and France. We had a variety of equipment, about 12 different friction testers in aircraft ranging from the FAA Boeing 727, NASA's Boeing 757, the 767 used in Japan. There was a series of 767 flights that we collected data on. The Dornier 328 in Germany, A320 as well as the Canadian Dash 8 and Falcon 20.

As our testing progressed, we gathered more data, and we disseminated our findings through international meetings. We had a total of three meetings which were attended by over 150 delegates worldwide each time. We disseminated the information, reviewed program results, obtained the support, advice and recommendations from the participants. The participants represented over 12 countries and 30 organizations. The last meeting was in Montreal in November 2004 at ICAO Facilities. Results of the tests were presented, and we had a very lively panel discussion and what emerged from that meeting was general agreement that the science behind an international runway friction index was workable. However, the results of the research needed to be turned into useful and practical tools for all stakeholders.

Since 1996, the Joint Winter Program has provided a tremendous learning platform. Improvement in awareness with respect to friction equipment over the years has been a direct result of the program. Testing with equipment from various makes and manufacturers at different airports around the world has raised the level of awareness among operators. Manufacturers of this equipment have also come to realize that their equipment is not as reliable as they initially thought, and in Canada, due to our past airport infrastructure, we have been able to apply the program findings in a practical way.

Now based on the real test data, we have been able to raise the confidence of pilots and airport operators dealing with contaminated runways.

The program data has been compiled in a database that's available to the public which contains over 275 aircraft runs and 10,000 ground friction measurements. The database is unique since it's the most extensive worldwide comparing aircraft braking with ground friction vehicle measurements.

Also a lot of the surfaces in the database were unnatural conditions. So to reproduce it would be quite an achievement.

In Canada, ops guidance material has been improved as a result of the findings in the Joint Winter Runway Friction Program. We use a decelerometer to provide meaningful information to the pilot on the slipperiness of the runway. The readings are taken by this instrument that you see there on the slide, averaged and reported as the Canadian friction number. Basically this instrument is strapped to a truck and it goes up and down the runway and takes measurements every 1,000 feet.

Airports throughout Canada are equipped with decelerometers. These devices are only used during wintertime and on the following surfaces: ice, frost, wet ice or ice covered with a thin film of water, sand, aggregate material, whenever anti-icing or deicing chemicals have been applied on the runway, on compacted snow, loose snow not exceeding 2.5 inches -- 1 inch, sorry, and on ice covered by slush.

Under certain conditions, the decelerometer readings may be inaccurate and therefore are not taken. So a CRFI is not provided to pilots when any of the following conditions are present: wet surfaces with no other contaminant, a slush layer with no other contaminant, when there's loose snow on the runway exceeding 1 inch in depth.

Once a CRFI number is taken, it is reported along with an overall description of the runway. This is taken by a trained airport operator, and the information is written down in an aircraft movement surface condition report. This report is sent to the tower which in turn is provided to the pilots through air traffic services or NOTAMs. Pilots also have their own reports of PIREP which are provided when available and indicate aircraft type and braking action.

This is a typical aircraft movement surface condition report. On the upper hand left corner, you have your CRFI number, and on the right you have your surface description with other information as well. The location of the contaminant is also included in the observation area. Typically during a pre-flight check, a NOTAM would be available, usually in Canada, we call it a NOTAMJ which describes the surface -- runway surface conditions only. Once airborne, the crew would get their information through ATIS. With rapid changing conditions, they would get verbal updates through the tower on a continual basis.

As a result of the program, we've also refined landing distance tables that have been developed. The way CRFI is applied is that once a decel measurement is taken, that measurement under certain conditions can be used to predict how much landing distance an aircraft will need. These tables are intended to be used at the pilot's discretion.

Now aircraft manufacturers do provide data to address contaminated runways. However, this data doesn't relate aircraft braking -- friction to friction measurements. So therefore, if an operator chooses to override a manufacturer's data, that's their own individual choice. And if they don't, they can still use CRFI in order to provide a heads up to their pilots regardless of what the operator chooses to do. Here's an example of what a CRFI table looks like. Pilots use these tables in the following manner. Every aircraft has an aircraft flight manual. Landing distance on bare and dry runways are provides in these manuals. These manuals are aircraft specific. What the tables do is take the landing distance required on a bare and dry pavement, and provide additional landing length depending on what the CRFI number is. For example, the Southwest Aircraft at Midway which had an unfactored landing distance of 3,030 feet, on a bare and dry pavement would have needed 5,400 feet using thrust reversers if the friction readings were .4. However, if the friction reading would have been .28, the landing distance would have been 5,970 feet. I'm just the .28 as a difference in what a friction value could mean in terms of runway length.

We also have a table with no use of thrust reversers. Now using that table, the landing length required would have been 5,980 feet with a .4 friction reading and 6,850 feet with a .28 friction reading. Therefore, these tables along with a description of what the surface condition is, gives the pilot a heads up of what to expect.

Part of the CRFI system is we also have this particular table which provides an indication of the range of CRFI values for certain surface conditions. It is not meant to be used to pick an approximately CRFI to calculate landing distance, and would likely give erroneous information if used for this purpose. If one was to use that table, then depending on the operator's plan and risk level, he may opt to choose CRFI numbers other than ones at the lower end of the scale. In other words, if a pilot -- an operator was going into an area that he's familiar with and for some reason didn't have a CRFI number or the decel device wasn't available or broken, they could estimate more or less, based on experience, what to expect in terms of CRFI based on the surface condition information that they would be provided.

For the Midway flight, the reported surface condition range may have between .16 to .76, if there was less than 3 millimeters of snow. Therefore, a reported value of .67 might have been within that range.

Until the aviation community adopts an international system, in Canada, we are very confident to use the CRFI, even though there are limitations such as operator technique. There's long runway occupancy times and the landing distance variation may vary depending on the sort of vehicle use, for example, if you're using a half-ton truck or three-quarter ton truck, if there's various decelerometer types, these may have a small effect on the landing distance.

We still think it's the cheapest method so far, and we do have test data supporting the findings for the use of it.

Although in Canada we use CRFI, in other countries such as Finland uses a similar method, the aviation community is still without a common indicator of friction. There are no local or international mechanism or bodies that monitor the ongoing equipment performance, and reporting and measuring procedures still vary from airport to airport and country to country. This is one of the things that we're trying to correct throughout our program since 1996.

Now if we are going to work towards an international method, there's various outstanding items that need to be addressed. We still need to make a final decision on IRFI, meaning International Runway Friction Index, a final decision on a vehicle. In Canada, because of our airport infrastructure, we did use a diesel but if that is not utilized and something else is decided on, we still need to take that challenge on. We also need to harmonize and calibrate devices. We need to choose master and local device which need to be refined against the standard device. We need to establish procedures and guidelines to implement the IRFI worldwide, and also we need to establish a strong relationship between IRFI and the aircraft braking performance. Now we have done that with a diesel but if we choose, go ahead and once we have our international standard device, the landing distance tables need to be developed as well.

And also we need to make sure that whatever system is implemented, that new technology for evaluating runway surfaces could easily be incorporated in the future.

In order to accomplish this, we've been trying to get ICAO to have a working group on friction, and the Air Jones Operations Services Group has actually taken that on and will be deciding if a friction group is to be established early September. We do have a library of information that can be accessed and hopefully this friction group will be able to go into it and take whatever information is necessary.

Also, we need to provide industry with a continued campaign of information and presentations where required. A key element in the limitation of an international method is to conduct workshops at airports, so that a practical and fundamental understanding of the key concepts can be grasped through sharing of problems amongst peers because one of the things we found when we did our testing from airport to airport, the fact that there was a variety of equipment being brought in from one side to the other, the airport operators came to a quick understanding of some of the problems and difficulties that they could encounter when using certain types of equipment.

And finally, if we are going to proceed, we do need a financial commitment to address the outstanding items.

On behalf of myself and all the people involved in the Joint Winter Runway Friction Program, I want to thank NTSB and the people at this committee. Thank you.

CHAIRMAN ROSENKER: Thank you very much. Mr. Yager?

MR. BENZON: It might be better if you gents just switch seats there. We don't want to mess up the cords there.

MR. YAGER: Good morning, ladies and gentlemen. Again, my name is Tom Yager from NASA Langley Research Center. NASA Langley as well as the FAA has joined with our partner, Transport Canada, in this Joint Winter Runway Friction Program that got started in 1996 and is scheduled right now on paper to end in December of this year, and I'm hopeful that we'll be able to get support to continue this effort.

This is our logo. We've got several international organizations involved in the program as Angelo mentioned, and over the 10 years, approximately 40 different organizations that participated.

Some of the test aircraft that we've looked at, the Falcon 20 on the upper left, the Dash 8 on the upper right, the 727-100 from the FAA in the middle, the 737-100 on the lower left, and the 757-100 on the lower right side of the chart. These airplanes together with five others have been able to collect data under just manual braking conditions on a variety of winter runway conditions, including wet runway conditions.

Some of the ground test vehicles that we've looked at are shown here. The instrumented tire test vehicle and the diagonal brake vehicle are operated by NASA Langley. The electronic recording decelerometer vehicle on the upper right is a vehicle operated by Transport Canada with the decelerometer on board to give them the CRFI measurements. We've got a FAA van in the lower left side of the chart, an airport surface friction tester in the middle and a surface friction tester operated by Transport Canada in the lower right.

Each of these vehicles in their test procedure operate with different tires, with different braking systems, and normally at the same speed. And, for instance, the electronic recording decelerometer device as well as the diagonal brake vehicle operate under locked wheel conditions or

100 percent slip, whereas the runway friction tester, the airport surface friction tester and the surface friction tester on the lower right, they operate on what we call the front side of the Mu-slip curve. By slip ratio or slip, I mean a 0 percent slip, the tire is free rolling. At locked wheel conditions is at 100 percent slip. And these devices along with the trailer devices operate normally between 15 and 20 percent slip.

Now your airplane automatic braking system will try and seek that same percentage when it's being activated on an airplane but, of course, airplane tires and ground vehicle tires have some major differences that through the use of the data that we've collected in this program, we have been able to harmonize the values of the different ground vehicle devices based on tire tread design, inflation pressure and speed, and then from that harmonization, come up with this International Runway Friction Index, and it's this International Runway Friction Index that we're comparing to the airplane braking -- effective braking friction coefficient. We're not comparing it to the airplane stopping distance when combined with reverse thrust.

This is a chart here indicating on the left-hand side of the aircraft, effective Mu values and on the lower, horizontal axis, the IRFI values, the International Runway Friction Index. And it shows data that we've collected from five different airplanes, the 737-100, 727-100, the Dash 8, the Boeing 757-100 and the F20 Falcon Jet.

You can see the agreement between aircraft Mu as measured under a variety of winter runway conditions, does have a fairly good agreement with the IRFI measurement.

We've come up with a table of operational ground vehicle friction levels. I admit this is hard to read but basically based on a friction rating of good, fair, poor, we've listed 12 different devices that give measurements in that range of friction reading, and for the decelerometer readings, a good reading would be .53 or above, fair would be .37 to .53, and poor would be equal to or less than .36.

Locked wheel devices, give somewhat lower numbers and the vehicles that operate between 15 and 20 percent slip gives somewhat higher numbers.

A lot depends, you read the notes, on the type of tire you're using, whether it be a smooth tread or a tire that has circumferential grooves in it or a tread pattern and, of course, inflation pressure plays a role in the amount of friction that can be developed between the tire and the winter contaminated surface.

Angelo went into this, the statistics for the program and we have established the Canadian and International Runway Friction Indexes. The International Runway Friction Index is now in an ASTM E.17 standard in their Volume 04.03, and we're continuing to upgrade that standard through the committee task group work. We just had a meeting May 20th over in Chincoteague, Virginia, where we're going to try and update not only the International Runway Friction Index but also our standard on the use of decelerometers on vehicles with and without anti-skid braking. The anti-skid braking on ground vehicles does play a role in the value measured by these decelerometer devices.

Runway surface friction evaluations over the years have shown us that the friction coefficient versus speed, the slope of that curve is a function of the macrotexture or the heavy texture on the pavement surface, whereas the magnitude or the value of the friction coefficient is a function of the microtexture and, of course, if you have several inches of snow and ice on a given runway surface, whether it be grooved or porous friction, porous, it doesn't matter. If the tire cannot see that friction, it won't develop the level of friction necessary or what would be expected on a bare, wet pavement.

This is the current friction level classification for the variety of continuous friction measuring devices that are available to airport operators, and you can see that at 40 miles per hour, you get higher values than you do at 60 miles per hour, or the limits are higher, and that's simply due to the fact that speed does play a role in the magnitude of the friction that's developed between the tire and the pavement.

This chart on functional ground vehicle friction levels is put together on a -- level basis, the conception level, the maintenance level and the minimum level, and again, ground speed at 65 kilometers per hour or 40 miles per hour and 95 kilometers per hours or 60 miles per hour, is indicated for 8 different devices here including the locked wheel devices and the surface friction tester devices. And, the French trailer device, the IMAG unit on the far right, is being considered as a reference vehicle right now, although that decision has yet to be made. It's operated by the French Aviation Organization over in France, and it's been involved in our Joint Winter Runway Friction Program since we started the program.

Bottom line, there are many different factors that influence aircraft ground handling performance, no doubt about it, not only the airplane, the aircrew, but the runway surface itself and the conditions, and some of these same variables affect the ground vehicle friction measurements, and a measurement taken during a snowstorm at 10:00 in the morning could be entirely different at 10:15 in the morning due to changing weather conditions.

The variables that I've identified in this chart, of course, number one is operator. We need to properly train the operators of these devices so that measurements taken at Chicago Midway can be comparable to measurements taken at New York Kennedy Airport with the same equipment.

We've started an effort, and we've gotten the Congressional funding to implement establishing calibration centers around the country to properly calibrate these runway friction testers and their operators on a yearly basis, and we're hoping to get the first one started in Tampa, Florida, later on this year.

Test procedures is another question that needs to be addressed not only through the ASTM Committee, but also through FAA as to how these continuous friction measuring vehicles should be operated at each and every airport facility.

Runway conditions vary, braking methods vary, and compliance to existing standards are issues that continue to make the measurements more variable than what they should be. And, of course, in our data collection during the Joint Winter Runway Friction Program, we kept track of these variables and could discern how they affected the data and make rational judgments on how to take the friction measurement and convert it into an International Runway Friction Index.

As Angelo mentioned, we still have work to do. We want to get more data on wide-bodied airplanes and we would like to continue the Joint Winter Runway Friction Program past the December ending timeframe which has been established by the current paperwork.

Anyhow, with that being said, I'll turn it over to the next speaker.

CHAIRMAN ROSENKER: Thank you very much, Mr. Yager. Mr. Marinelli.

MR. MARINELLI: Thank you. I'm going to try to go through this as quickly as I can. I'm going to try to avoid repeating a lot of the material that Mr. Boccanfuso and Mr. Yager have already presented.

As they said, research started in the sixties. FAA has been involved in that since the very beginning. At that time, those early studies found no direct relation with aircraft performance but found we could use runway friction tests for maintenance purposes such as rubber deposits and their scheduled removal.

In 1982, World Airways Flight 30 went off the runway at Boston, and NTSB issued some recommendations as a result of that, basically that we should be looking for a method of disseminating runway friction information to pilots. Subsequently, Tower Air Flight 41 in 1995, NTSB pretty much reiterated a similar recommendation.

Back in the early nineties, FAA formed a Winter Runway Friction Measurement Reporting Working Group consisting of the associations here, and in 1995, that group issued a report summarizing the history of runway friction measurement, noted Transport Canada systems, and found, and this is a critical point that all FAA approved continued restriction measuring equipment and decelerometers produced statistically equal measuring values basically when the Mu reading was below 40. That conventional wisdom has changed since then, and I'll go into that a little bit later.

Some of the recommendations of that group report were to airports to conduct and report friction measurements, improve our guidance fund friction measurement devices for airports, continue research and to form a group to develop operational criteria, and that group is the Joint Winter Runway Friction Measurement Program that you've heard described.

Our response to those recommendations were to, in certain -- guidance, the fact that it was necessary to report the type of runway fixture measuring device because again the conventional wisdom said that they all read the same at the numbers below 40. We did make friction measuring equipment eligible for federal funding, and FAA through the FAA Technical Center acquired a fleet of runway friction testing equipment to participate in that joint program.

Our current guidance includes two advisory circulars, one on measurement of skid resistant airport pavement services, that lists the approved continuous friction measuring equipment, and our advisory circular on airport winter safety and operations which not only lists approved decelerometers but provides guidance for airports on conducting friction tests. The limits for conducting those tests are the same for all approved equipment, loose snow up to 1 inch, and slush up to

1/8 of an inch.

Now we presently do support the use of friction tests for both maintenance and operational purposes. We do feel that mu readings are less subjective than braking action reports but the numbers are merely one extra data point for a pilot to use in his decision making.

Benefits of continuous friction measuring equipment are that it provides a continuous trace of the runway length and it is a much shorter test in time than decelerometers, and here I have the list of the approved continuous friction measuring equipment by FAA. Decelerometers provide spot readings and those spot readings will generally be taken on contaminated areas. So if you have patchy conditions, you'd normally get a conservative reading. As I said, the runway test will take longer, and we have the four FAA approved devices.

I was asked to address the question of deicing fluids and how they affect the runway friction. The fact is that any fluid poured on ice will decrease the friction but the proper use of deicing fluids would require mechanical removal and at that point, just the deicing fluid on the runway should be really no worse than a wet runway condition.

Our guidance for transmitting information from the airport to the tower to the pilot are contained in these advisory circulars. I won't read them off to you but -- and the FAA orders that speak to how the information is transmitted to the pilots through both ATIS and through reading on a request. And pilots are provided information in the aeronautical information manual.

Our involvement in the Joint Winter Runway Friction Measurement Program includes providing equipment and personnel for the testing program. We sponsored a membership of an engineer to the committee E.17 that Mr. Yager spoke about earlier. We participate in the international meeting on performance of aircraft on contaminated runways as Mr. Boccanfuso mentioned earlier, and we co-chair the R&D Committee at the American Association of Airport Executives, Northeast Chapter, no symposium.

Recent developments in friction testing show that, in fact, the friction testers do not all provide equal readings, and that is the genesis of the IRFI. We had to revise our advisory circular to identify the type of friction tester and provide that information to the pilot in addition to the numbers. And the ASTM Committee did accept the task to develop IRFI and subsequently the AFI which would relate aircraft braking performance to IRFI.

Some issues that we have with the IRFI, it says specifically within it, the standard does not address the braking performance of an aircraft. It can be used by airport personnel to monitor their snow removal operations. We're not sure of what the accuracy for unknown conditions such as mixed contaminants on the runway. It does require an extensive calibration network consisting of the benchmark or reference device that was spoken about earlier, and it really hasn't been decided on yet. It would have to be multiple regional devices, so-called master devices, that would be harmonized with the reference device and then local devices that would be harmonized with the regional devices.

And finally, all equipment would have to be recalibrated on a periodic basis which the IRFI calls the time stability of the devices which has so far not been established.

I believe this was in 2004 that FAA wrote its response to NTSB's recommendation. I won't read these quotes, but basically said that we don't believe the IRFI is practical for deployment at U.S. airports and NTSB accepted that as closed and reconsidered. Regardless, we do continue to monitor and support the efforts. We support the Joint Winter Friction Measuring Program and will continue to do so. Our goal is to provide information to pilots, the best information that we can.

Our Technical Center is not conducting any independent research right now. We believe that the existing international effort is the way to address this.

And finally, I will note that there has been some mounting interest in the use of data from landing aircraft being passed along to subsequent aircraft.

We will adopt any practical changes that come along that will provide better information to pilots, and I will note that the preliminary information from the Southwest 1248 accident pretty much supports our position on runway friction measurement in that I understand the numbers were of such a value that it would have indicated adequate runway to the pilot. And that concludes my presentation. Thank you.

CHAIRMAN ROSENKER: Thank you very much. Mr. Geisman.

MR. GEISMAN: Thank you, Mr. Chairman. Good morning. My name is Paul Geisman, and I work at Boeing Flight Operations Engineering.

Before I start, I want to note that I will primarily read from notes to insure accuracy during my presentation.

I was asked to participate in this panel on methods and accuracy of runway condition reporting and the relationship to airplane performance. There are three methods of reporting runway conditions. Method 1, as listed here, is airplane braking action reports. Method 2 is a description of the runway surface as observed. And, Method 3 is a measurement of runway friction by the device designed for this purpose.

Each of these methods of reporting runway condition have limitations on the accuracy associated with it. I will provide information on that accuracy looking at it from the perspective of the airplane stopping performance.

The first method I will address are braking action reports. Braking action reports are subjective evaluations of the available braking action as perceived by the flight crew. Descriptive terms such as good or poor are used. These are typically reported to ATC following the landing. ATC then reports them to approaching airplanes and other interested parties such as the airport management and airline operations. An example of a report would be braking action good for the first time or for the second time.

The second method is runway description of field reports. This is a description of the observed runway -- Terms such as snow and ice are used. If appropriate, a depth would be included. These reports are obtained by the airport management and they are warranted by the conditions and they are typically reported by an automatic terminal information system which -- An example of a runway description would be 90 percent of the runway is covered with a trace of, 1/16 inch of wet snow, 10 percent termed wet, snow removal -- .

The third method, runway friction reports, are quantitative measurement of runway surface -- measuring equipment. This is done by airport management when deemed necessary. This information is typically reported -- runway. The measurements are recorded in whole number such as 72, 59, 68, and it may include an average. These are included --

necessary.

In this example, ice is the contaminant -- excuse me. An example of the friction report is runway 27, mu 42, 41, 28, at 018Z ice. In this example, ice is the contaminant that is the reason for the friction report. Mu is the Greek letter that is used as a symbol for friction and 018Z is the time of the measurement.

I will now show the runway condition reporting methods pictorially. Method one is a pilot evaluation of the airplane braking capability at the time of the landing. There are two standards for reporting this airplane braking action. One is from the International Civil Aviation Organization, and the other is reflected in FAA and Transport Canada material. The important point is airplane stopping performance is being described at the time of the landing.

At Boeing, we provide advisory landing distance information in the quick reference handbook which is related to braking action. We provide this information for braking actions of good, medium and poor. The other two methods of reporting are descriptions of the runway, one an observation and the other a measurement. These are accomplished at a point in time and do not account for rapidly changing conditions. A friction report can only be taken when an airplane operation has been suspended.

I will now address the accuracy of the three methods of runway condition reporting, starting with what I have labeled as method one, airplane braking action. As noted earlier, the braking action is a subjective evaluation of the airplane stopping capability by the flight crew. This can be influenced by the type of airplane being flown, how the airplane was flown, the flight crew experience and other factors.

The following is an example of an attempt to quantify the accuracy of the braking action. If the flight crew reports the braking action to be good, but the actual conditions are more like medium, the required stopping distance will be increased by approximately 1300 feet. If the flight crew reports the braking action to be medium, but the actual conditions are more like poor, the required stopping distance will increase by approximately 1500 feet.

Now let's take a look at the accuracy of a field report of what I have labeled as method two, the runway description. This data presented is based on an evaluation of compact snow and ice data as reported in the 2004 Joint Winter Friction Test Program database which was compiled by NASA and Transport Canada. An evaluation of the accuracy based on the airplane data in this study shows that for a simple verbal description of compact snow, the variability of airplane stopping distance could be up to 1,000 feet. For a simple verbal description of ice, the variability in airplane stopping distance could be up to 2,000 feet.

The Boeing QRH advisory data labeled as braking action medium is on the conservative side for compact snow. The Boeing QRH advisory data labeled as braking action poor is on the conservative side for a generic ice description. This Boeing QRH advisory data will be discussed in more detail in later testimony.

This brings us to method three, that is runway friction reports. These are measurements of the runway friction as measured by a vehicle or a towed device. As you have seen, NASA and Transport Canada have done much work attempting to relate these friction measuring vehicles to each other and to the airplane stopping performance. To date, there is not a universally agreed upon relationship between the runway friction as measured by these devices and the airplane stopping performance.

Another issue that comes with runway friction reports is time. During airport operations, the conditions may be changing quickly with time. For example, additional snow accumulation may change the runway friction characteristics, a rise in temperature or direct sunlight may change the friction characteristics of ice, as may additional traffic. Therefore, when using friction reports, the user needs to be aware of when it was taken and what the conditions at the airport were at the time the friction measurement was taken.

I'm now going to present the runway condition reporting derived from the airport survival factors group factual report, the ATC factual report and the aircraft performance group study for December 8 of 2005 at Midway.

The time on the horizontal axis is referenced to the time of the accident. I'm going to present the events that occurred after the runway had been cleaned, approximately 30 minutes before the accident. The vertical axis in this presentation is braking action. A friction test was accomplished shortly after the runway had been cleaned. This friction test indicated the level of friction available in the good to dry range. Shortly after this friction test, flight operations restarted and pilots reports of braking action were furnished to ATC. The first report was fair. This was followed by a report of fair, and it's poor at the end. The next airplane did not provide a braking action report. The following airplane reported braking action at the far end of the runway is poor and after a flight delay, they also reported good first half of 31C, poor the second half. There was no report for the next airplane. A citation reported it's poor right now. Finally, a Goldstream reported fair to poor.

Following the accident, another friction test was conducted. This measurement showed a degradation from the initial test, about 40 minutes earlier. This is not surprising as the conditions were changing.

Finally, I will add to this charge an evaluation of the airplane braking characteristics as determined from the flight data recorder information, from the 737s that landed at Midway in this time period. This data is based on an evaluation of the aircraft performance group study and shows the changing airplane performance as the runway conditions were changing. This information demonstrates the difficult issues that are associated with operation on slippery runways, not the least of which is the effect of time on the available runway friction and therefore on the airplane's stopping performance.

In summary, I have provided a high level review of the three methods of reporting runway conditions and some of the limitations on the accuracy associated with these three methods. Thank you for your attention.

CHAIRMAN ROSENKER: Thank you very much, Mr. Geisman. Captain DeGroh? Upon completion of Captain DeGroh's presentation, we'll turn it over to the Technical Panel for questions.

CAPT. DeGROH: Thank you, Mr. Chairman. Contaminated runway issues from the pilot's point of view, I'll try to keep it kind of brief because a lot of what I wanted to talk about has been touched on by the other panelists. But contaminated runways continue to be problematic for landing and takeoff. Each winter, crews are faced with problems of less than optimal runway clearing, untimely reports, runway condition reports that don't reflect the actual conditions existing on the runway, in many cases, the lack of performance information available to the crew for operations on contaminated runways.

Effectively mitigating the hazards posed by contaminated runways is a system safety problem. The puzzle has a number of elements, some of which are airport surface assessment reporting, aircraft performance and some -- guidance. Much of this panel is focused on the surface assessment and reporting. Some of my discussion topics have been a little bit addressed here by the previous panel. So I'll try to keep it brief.

I was going to talk a little bit about surface assessment reporting, some additional remarks on aircraft performance and airports and some final thoughts.

What's contaminated? Various terms are used to describe things that aren't supposed to be on the runway, and it varies. For my discussion, a dry runway is going to be considered neither wet nor contaminated. A wet runway is one on which the water depth is no more than 3 millimeters and contaminated more that 25 percent of the required field length covered by a water depth exceeding 3 millimeters or any depth of slush, snow, ice or other friction degrading substances.

Why is it a problem? I think we all understand that. It decreases the aircraft's stopping ability for landing for sure, and also it must be considered for the takeoff, the potential for rejected takeoff. Loose material will degrade the aircraft acceleration on takeoff causing the V1 speed to be further down the runway, reducing screen height and reducing the runway available in the case of a rejected takeoff.

Surface assessments, Paul talked about three methods of surface assessments, and the pilots are familiar with them, braking action advisories, friction measurements and contaminate type and depth. I think many pilots are most familiar with braking action advisories, something that we started off learning about. The U.S. terms include good, fair, poor and nil, and the ICAO terms are listed in that second bullet, slightly different than the U.S. terms, and because of the variability or the subjectivity of these assessments, perhaps a unified system of terms would be useful.

Because it's a subjective assessment that's made by the pilot based on how he feels the airplane is decelerating, it's going to vary from pilot to pilot, from aircraft to aircraft. A pilot that's based in Miami flying up to Detroit in the winter will probably report a significantly different braking action report than a pilot who is based at that airport in Detroit. There's a lack of defined criteria to assist pilots in choosing the most appropriate term. The aeronautical manual does include information and guidance for pilots on characterizing icing intensities and turbulence intensities but there is no such equivalent for braking action advisories.

The relation to aircraft performance I think was touched on a little bit in that this is kind of a big bullet in that how do you relate this stuff to the aircraft performance. If the crew is provided with advisory data, provided by the manufacturer through their company, that information is oftentimes given in terms of braking action and surface condition, but we must remember that many crews do not have even this advisory information because the U.S. regulations currently don't require it. Under European Aviation Safety Regulations, advisory or guidance material for operations on contaminated runways are required to be provided to the crew and used by the operator, but that equivalent requirement doesn't exist in the U.S. So many crews don't have the information, which they need to make an assessment of the adequacy of the runway.

The other, sort of the downside with braking action advisories is that it requires a test subject. Somebody's actually got to land on that runway and make the assessment, and it may be your unlucky day.

The second method mentioned was friction index and lots of information presented by the panelists here regarding friction index. We need to boil it down so a pilot can understand it and use it. The International Runway Friction Index is one way to go. Unfortunately, we don't see it. We don't have it in our hands right now for the pilots to use it, and there is limitations as was mentioned with respect to these friction measurement devices. The FAA in the airport winter ops, safety and winter operations advisory circular basically says that runway friction measurement equipment's unreliable in more than 3 millimeters of wet snow or more than an inch of dry snow. These are conditions for which we need the information, and it doesn’t exist for us to use it. And because of that unreliability, I think the manufacturers are reluctant to try to tie aircraft performance to these values.

Friction index oftentimes is taken at face value by many pilots. I remember when I started off, my first report of seeing a friction value, well, what do I do with this? I have no information available to me to give me guidance how to use that information. So consequently crews are not given that information as a function of the friction measurement, and so don't have a direct perhaps use for the friction index. So what do I end up doing? I go to a table that many operators provide their crews which attempts to relate braking action and runway friction coefficient, and I'll try to find it and put it in terms that I'm used to seeing, and that's the braking action.

These particular tables came from the ICAO NX14. The problem with it, and I think many pilots understand this, too, is that there's some questionable relationship here because we're talking about a runway friction which we think of as a measurement being compared to a braking action which is a subjective assessment, but for many of us, that's all we have to go by.

Angelo talked about the medium runway friction index. What a great system. When we first -- when I first heard about it, I thought it was a wonderful way to go especially since it's based on aircraft testing in winter conditions, not advisory data that's calculated but backed up and substantiated by actual aircraft testing. It's simple to use, a simple look up table, and pilots have told me numerous times whatever we come up needs to be simple to use because they have lots of other things going on in the cockpit to have their head down into some spaghetti chart trying to determine the runway length requirements.

What's interesting is that the Canadians have this, and many U.S. pilots are aware of what CRFI stands for, what it means but in their operations manuals, they're not provided with the tables. So it sort of renders the CRFI value somewhat useless to a U.S. pilot perhaps because the CRFI values are really only used up in Canada, and, and that same system is not down here in the States.

Angelo already showed an example of the CRFI table but CRFI is not the entire answer. It's a step in the right direction. It's only an average value for the entire runway. Canadian pilots have expressed an interest to have CRFI expressed in thirds of a runway, the touchdown zone, mid and roll out ends, as a better idea of what the runway conditions really are, and again it suffers from the same and similar limitations of the -- that the FAA pointed out in their winter ops guide. Not applicable for takeoff is another limitation, but it is a step in the right direction.

And Paul mentioned surface contaminant type and depth. That's the third way. I've seen with respect to going back to the friction measurements, Tom talked about the variability and repeatability issue. I remember seeing some, I think it was sort of raw data of friction measuring device being run down the test surface 24 times and the average difference in friction value during those 24 runs was a .18. That's basically you can take that device, run it down that surface and return a value of .4, which if you look at the ICAO table is equivalent to a good. You run the device again and you might return a value of .22 which comes out to be poor. So there is some issues with repeatability that hopefully the International Runway Friction Index would take care of but in the meantime, perhaps assessing runway conditions in terms of contaminant type and depth and relating that to aircraft performance through perhaps entertaining the thought of actually testing the airplane in those conditions, that our limitations for the use of the runway friction measurement equipment, typically the deeper depths of snow and perhaps slush, to sort of fill in the gap.

As a reminder, aircraft testing is not required on anything but dry runways. Dry runway data is what's in the certified data for the certification requirements for the airplane but there is no requirement to go ahead and actually test for landing on a wet runway.

Sources of reporting information, runway surface information include Automatic Terminal Information Service, air traffic control, dispatch, flight service and other pilots. We talked a little bit about the NOTAM system, notice to airman. That's a wonderful system. It has great use for lots of information that we need especially before we depart but the problem with it is that it tells the pilot what was and not necessarily what is especially when we're talking about runway conditions and rapidly changing precipitation events.

Runway surface condition reports need to be standardized, accurate and timely. Some problem areas that pilots have reported are reports that over an hour old, reports that don't reflect the actual conditions on the runway or poor communication between the airport personnel and ATC. Examples of pilots calling ATC for a runway surface condition report and ATC saying, well, we don't have any of that information. That points to a problem in the communication process. And runway surface condition reports for non-tower reports. I mean this problem is not just for large airplanes at major hub airports.

It also includes the small regional jets and regional aircraft that fly to the smaller outstations, and it becomes a little bit more of a problem at those places.

Some of the things pilots like to see, this is not an endorsement for this thing. I think many pilots would rather not have more coded information but the idea here is that the pilots would like to see the time of the observation. They'd like to see the type of contaminant on each third of the runway, the depth of that contaminant on each third, the runway friction value for each third, and then also it would be useful for the pilot to know when was the last time the runway was cleaned and when is the next time it's expected to be cleaned or maintained.

Some brief, real brief remarks, I'll try to keep it short, regarding performance. Emphasis here is being placed on the landing problem but for every flight there's a takeoff, and contaminant runway takeoffs arguably can be more critical. The aircraft is heavy with fuel. Acceleration is impeded reducing screen height and projected takeoffs, has the same issues as the landing but with much less runway available to stop.

A landing is required on every flight. RTOs don't happen that often due to the very good reliability with the aircraft. But with the landing, there's a risk exposure that perhaps exceeds that RTO but again it's a system safety problem, and it needs to be addressed across the board.

Airports, runway clearing is impacted by ops tempo. Basically it's going to require shutting the runway down and with a high arrival rates and departures, that becomes a very significant problem for airports to tackle. Contaminants can obscure the touchdown zone markings, including the runway center line markings which may make line up of the aircraft difficult and give the pilot a little bit more difficulty in determining his actual touchdown point or detecting errors where that touchdown point may be. The other problem area is the conditions vary along the runway length due to the tempo of operation especially on the touchdown zone area, airplanes departing, aircraft landing in that same area, pilots have often reported that the conditions are much better in that area than it is in the roll out end which is an issue for the potential for rejected takeoff.

Because aircraft certification data is based on dry runway conditions and calculated only for other conditions, it's important that runway clearing be accomplished in an expedient manner. Again, no data for other than dry that's tested, wet data is computed based on dry.

Some final thoughts. This isn't a new issue. These issues have been discussed at a previous public hearing back in 1982, reported in an NTSB special investigation report in '83, but some progress has been made. You've learned quite a bit of information and research has been done in the past few years but from a pilot's point of view, it's a bit discouraging because on the pointy end of the stick, I still don't have something solid that I can use to help me make an assessment of the suitability of a runway based on those runway conditions. It turns out to be more of an art than a science.

Excursions continue to occur on wet and contaminated runways. You know, pilots make decisions every day on every flight, involves inputs from many different sources. Those, those information sources need to be accurate and timely because our sound decision making is going to come from timely and accurate information.

Lastly, all the pieces of the puzzle have to fit together. As I said, it's a safety system issue, to mitigate the risks of runway overruns in winter conditions. ALPA believes that all parties should be involved in any potential solutions and we stand ready to work with the FAA and industry to work on a standard runway assessment and reporting and work with the manufacturers to develop the easy used performance information that the pilot can use to make an assessment of the runway length requirements. And that's all I have. Thank you very much.

CHAIRMAN ROSENKER: Thank you very much, Mr. DeGroh.

I'll turn it over to the Technical Panel for their questions. We'll start with Mark George.

MR. GEORGE: Thank you, Mr. Chairman. I'd like to start off with a rather provocative question for each of you and could you answer it fairly succinctly if you please. The question is, is it possible to predict aircraft braking performance from runway friction measurements? Mr. Boccanfuso?

MR. BOCCANFUSO: Although it's not an exact science but, yes, we believe in Canada we're able to do that with our CRFI system.

MR. GEORGE: Thank you. Mr. Yager.

MR. YAGER: Yes, we've demonstrated it's possible to do that with 12 different friction measuring devices.

MR. GEORGE: Thank you. Mr. Marinelli.

MR. MARINELLI: I'd like to defer that question to a later FAA witness, Mr. Don Stimson who has much more expertise in aircraft performance than I do.

MR. GEORGE: Okay. Mr. Geisman.

MR. GEISMAN: As you know, we do not relate our airplane performance directly to friction measurement because of the variability issues that have been discussed here today.

MR. GEORGE: Thank you. Mr. DeGroh.

CAPT. DeGROH: Well, I'd like to see that happen, give us a better sound basis for performance information but to be quite honest, and this is my opinion, I find it to be a little bit dubious perhaps just because of the limitations in those certain surface contaminants that the runway friction measurements have -- devices have. If we can overcome that, I think it will be useful.

MR. GEORGE: Thank you. Mr. Boccanfuso, you mentioned several contaminant types, I think loose snow and slush which the decelerometer type runway friction testers do not give reliable readings. How do those conditions affect the decelerometer readings? That is too high, too low, widely variable.

MR. BOCCANFUSO: Those type of conditions are basically affected by speed. So as a result, the hydroplaning effect, we wouldn't be able to use -- we don't recommend using decel devices.

And just on one other point. With respect to slush contaminant, when we've conducted our studies, we weren't able to get sufficient slush data. Slush is very hard to test on. So a lot of our results we've discounted slush saying that we can't measure it and that it's not reliable with respect to our CRFI tables but that is really because of the lack of data and the natural slush conditions that we try to test on that were unavailable, just basically very hard to simulate or even to get in terms of the last five, six years that we've conducted our testing.

MR. GEORGE: Thank you. Mr. Yager, in your experience, which runway contaminant types do not give reliable readings with continuous friction measurement equipment?

MR. YAGER: The patchy snow and ice condition gives us the greatest variability. I should probably describe our test procedure with instrumented airplanes during the Joint Winter Runway Friction Program. For a given surface condition, we will take measurements with the ground vehicles first and then the airplane would go through and make several test runs to cover the speed range from their landing speed down to a stop, and then after those three or four runs have been conducted, we go back out with the ground vehicles and collect another set of data. And so it's these two sets of ground vehicle data that we then compare to the airplane using a time scale and a temperature scale to reflect how the ground vehicle friction measurements converted to IRFI compared to the airplane stopping performance.

Now the airplane is stopping only using full wheel braking. It is not using reverse thrust. It's in a landing configuration with flaps and spoilers. And it's that type of data that we're successful in relating the IRFI to five different types of airplanes, and as I mentioned, we would like to get more data on wide bodied airplanes.

MR. GEORGE: Mr. Yager, also, is there a visible difference between wet snow and slush?

MR. YAGER: Other than the depth, to my way of thinking, there isn't a visible difference, particularly on a concrete runway. On an asphalt runway, you can get a better indication of the depth because of the black surface underneath.

MR. GEORGE: But they appear different? Slush would have a different appearance visually than --

MR. YAGER: Yes, it would be grayer than wet snow.

MR. GEORGE: Can vehicle activity cause slush to form from wet snow?

MR. YAGER: Most definitely. Normally vehicle test tires under operation are at a higher temperature than the ambient runway temperature or the contaminant temperature and hence will cause a melting effect on what the contaminant it.

MR. GEORGE: Could a think layer of slush be concealed by a layer of dry snow?

MR. YAGER: That would depend entirely on the temperature, how close you are to the freezing point. If you're below the freezing point, yes, it could but if you're slightly above, I wouldn't think it would be possible.

MR. GEORGE: Does application of deicing fluid tend to help or hurt the friction coefficient on a runway?

MR. YAGER: Again, it's an influence of temperature. The deicing fluid initially on an ice coated surface will reduce the friction level until that ice starts breaking up. The use of anti-icing chemicals on a bare pavement before the storm arrives can be more beneficial.

MR. GEORGE: How about if you get snowfall on a recently treated runway? What does that do to the friction coefficient compared to snow alone?

MR. YAGER: Well, the -- it's been my experience, once a deicing material has been placed on the runway, the snow does not accumulate at the rate it would without the deicing chemical. The deicing chemical essentially melts the snow particles as they arrive but, of course, there are some snowfall rates where it exceeds the capacity of the deicing material and can accumulate on a surface that has that chemical on it.

MR. GEORGE: And is that -- would that be slicker than just water underneath the snow?

MR. YAGER: That I couldn't tell you. I haven't gotten any measurements under those conditions.

MR. GEORGE: All right. Thank you. Mr. Marinelli, in conditions where you have slush exceeding an 1/2 of an inch or dry snow exceeding 1 inch, how are the friction readings affected? That is, do they tend to read too high, too low or widely variable?

MR. MARINELLI: I believe you tend to get a drag effect on the test tire from the increased depths, and that would result in a higher friction measurement than would be realistic.

MR. GEORGE: Slush, too?

MR. MARINELLI: That's correct.

MR. GEORGE: An 1/8 of an inch of slush? Do you know how the FAA arrived at the depth and type of contaminants that give unreliable readings?

MR. MARINELLI: Those numbers are all as a result of the joint program that we've been involved in.

MR. GEORGE: You said that the FAA supports or condones the use of the friction testers. Do you require airports to have and use friction testing devices?

MR. MARINELLI: No, there is no requirement. It's advisory guidance only.

MR. GEORGE: Do you have any idea why they're not required?

MR. MARINELLI: Well, we haven't found them to be reliable enough to result in a requirement.

MR. GEORGE: You may have touched on this, and I apologize if I'm repeating it, does the FAA anticipate any changes in policy or airport requirements based on the findings from the Southwest accident?

MR. MARINELLI: Not at this time. Based on the preliminary information that we have, the friction measurements that were taken before and after the Southwest accident support our guidance as it stands.

MR. GEORGE: Are you familiar with any products or devices that heat runway surfaces in order to clear contamination?

MR. MARINELLI: We have done some, some research on this through a cooperative research and development agreement with a company that makes a conductive asphalt. It's really simple thermodynamics. If you apply enough heat to a pavement, it will melt ice and snow. The problem that we have with all systems that have been proposed so far is both initial cost and the cost of operation. So we haven't found anything that's economically reasonable yet.

MR. GEORGE: In your research, have you looked at what -- the effects it has on the surface itself, the pavement, the asphalt, any higher degradation or quicker degradation since you had that system installed?

MR. MARINELLI: They may have been noted in our report from the Technical Center, but I have not read it completely. I'm not aware of that.

MR. GEORGE: Okay. So my -- this is sort of a guess. The FAA at this point has no policies, requirements or standards in regard to that sort of product?

MR. MARINELLI: That's correct.

MR. GEORGE: Thank you. Mr. Geisman, I have a couple for you. Looking at that third to the last slide in your presentation, and the chart, it has data points labeled as braking action as calculated from FDR data. I think they were diamond shaped. How did you decide where to put those on the sale of braking action reports and do their positions on that chart indicate any correlation of any kind?

MR. GEISMAN: Okay. Mr. George, what we did is took the information from the airplane, or excuse me, the aircraft performance group study which was an airplane braking coefficient, and related it directly to what we normally -- to what we use when we normally publish QRH data. In other words, we have an airplane braking coefficient that we relate to a breaking action for our normal publication purpose. So I used that directly.

MR. GEORGE: Can you explain the difference between aircraft braking coefficient and runway friction coefficient?

MR. GEISMAN: Okay. By runway friction coefficient, I'm assuming you're talking about the tire to ground friction, if you will, the interaction between the tire and the ground. With airplane braking coefficient, we're calculating the effect of tire to ground friction on the airplane's deceleration capability. Okay. That is calculated through a series of assumptions, and so basically you're measuring one is the tire to ground, and the other, the airplane's actual performance or the performance we expect that reflects that friction.

MR. GEORGE: Would those -- in one situation come up, would you come up with the same number for each one of those, the same value let's say?

MR. GEISMAN: The value, no, you would not, sir. You would not come up with the same value. They're a different entity.

MR. GEORGE: Okay. Is it possible to estimate that the aircraft braking coefficient in a real time manner from data generated by the airplane?

MR. GEISMAN: That gets to be a difficult question, sir, because of the real time. Obviously with the FDR data, because we presented the information, you can calculate an airplane braking coefficient from the FDR information. But there are many assumptions that go into that and information and, in fact, page 8 of the airport, or excuse me, the aircraft performance summary or study, excuse me, does an excellent job of listing the assumptions and the issues that become involved in that particular calculation.

MR. GEORGE: Mr. DeGroh, as a pilot, how likely are you to be given actual runway friction measurement as opposed to braking action reports?

CAPT. DeGROH: I think that's a little inconsistent. It seems to me that it -- you may get runway friction measurement on occasion going into certain airports, and some airports, they don't have that friction measurement available. So you may get braking action, and you might not get anything if no other airplane has landed before your arrival.

MR. GEORGE: But I was trying to get at, do you get them frequently where you'll get the actual friction numbers from the, from the mu meters at the airport?

CAPT. DeGROH: If the airport has the runway friction measurement equipment, and we ask ATC, we'll get it. Sometimes ATC does just offer it up if they have it.

MR. GEORGE: This is obviously an estimate. What percent of pilots that are out there flying right now have any -- enough training to understand what those numbers mean?

CAPT. DeGROH: You asked a question I can't answer. I don't have those statistics but I have maybe something that might be indicative to it, and it was actually a Transport Canada study had commissioned a study on a survey of Canadian pilots, and in that study as I recall, 20 percent of the pilots surveyed said they did not have training on the use of runway friction measurement equipment or runway friction measurements for contaminated runways. So there is, there is an issue there, I think on the training side of it, and I don't have the statistics. I'm sorry.

MR. GEORGE: You also mentioned that you thought CRFI was a step in the right direction. Are you aware of any efforts to get CRFI or something similar implemented by U.S. airlines?

CAPT. DeGROH: I am not aware currently of any effort to provide that information or make it operationally usable here in the States for U.S. airlines at this point in time.

MR. GEORGE: Is there any reason? What would stop it from some U.S. carrier from adopting it?

CAPT. DeGROH: Well, I think part of it would be --

see, up in Canada, you use the electronic recording decelerometer and one unit that they normalize that data for the development of the CRFI. In the States, there's any number of friction measurement devices as the FAA pointed out that are approved for these runway friction assessments. So you're attempting to compare apples and oranges I think, and it makes it probably unusable.

MR. GEORGE: Have you ever had any training on how to give a braking action report?

CAPT. DeGROH: No. I've come up with, in my own experience, what I feel like. For example, if I make the landing on a contaminated runway and the deceleration feels normal to me, and I'm able to make my planned exit point with what feels like normal braking, I might call that good. I can't call it dry obviously because there's something on the runway. I might call it good, and if we go down to where I feel that there is a definite degradation, deceleration, but I don't have to go to max brakes and I'm still able to make my runway turnoff, I might call that fair, but these are things that I've tried to come up with on my own to try to make accurate assessment of the runway braking action, not anything that's been trained.

MR. GEORGE: Okay. Those are all the questions I have. Thank you all very much. I'd like to turn it over to my colleague, Dr. Kevin Renze at this time.

DR. RENZE: Thank you. Nick, could you pull up the slide, figure 2 from the NASA or if it's not available, Mr. Yager, could you pull up figure 2 from your presentation. Thank you.

Mr. Boccanfuso, I'd just like to start with a couple of questions about the use of CRFI. First of all, how many operators use CRFI performance tables?

MR. BOCCANFUSO: You mean in Canada?

DR. RENZE: Yes.

MR. BOCCANFUSO: I can't really say because it is advisory material, and we did do a pilot survey where we surveyed about -- we sent out a questionnaire to about 3,000 pilots. We got a 11 percent response, and within that response, the majority of them said they did use it, and they highlighted some of the things that they wanted improved such as frequency of updates, the real time information, more accurate readings. So we do have a list of things that they wanted improved but for the actual number of operators who do use it, it's on a voluntary basis. So I wouldn't have that information.

DR. RENZE: Okay. Do you happen to know what percentage of operations would be conducted in a CRFI reportable condition versus dry or some other condition?

MR. BOCCANFUSO: Well, CRFI is only used during winter operations. So -- and it's only used under certain runway contaminants and runway conditions. So that's the only time we use it. It's not used on wet or during summer or bare and dry runways.

DR. RENZE: Okay. Thanks. Could we bring the figure back up please? With respect to this figure, I’m interested in the scatter on the vertical axis, and I'm curious as to your opinions, Mr. Yager and Mr. Boccanfuso, about what's tolerable in terms of the scatter on the vertical axis for aircraft mu, if you're trying to use these data to calculate aircraft performance?

MR. YAGER: To me what would be tolerable is plus or minus 5 percent on the aircraft mu scale versus the IRFI and admittedly some of the data points are not within this 5 percent tolerance limit, and we have explanations for why they're not. Such as the temperature might have been increased or decreased substantially from the time of the first ground vehicle test run until the time of the last ground vehicle test run.

DR. RENZE: Mr. Boccanfuso, when the CRFI performance tables were built up and some conservative margin was added, was a line similar to line shown here through the data used or was it drawn more conservatively or less conservatively or were there other additives that were considered to establish those tables?

MR. BOCCANFUSO: Not being a performance engineer, I'll try to answer that to the best of my ability. With respect to the CRFI, the line was a little bit more conservative but it wasn't this particular plot that we used. This plot has all the friction vehicles and aircraft all at the same listed on there. With respect to CRFI, we just had the CRFI versus aircraft mu and we had a 95 percent confidence level in that and as Tom as saying, there's 5 percent that were throwaway points. So to answer your question for CRFI, we wouldn't use this particular figure.

DR. RENZE: Does it show a similar trend in terms of the scatter on the vertical axis for the curve that you did use?

MR. BOCCANFUSO: No, it does not.

DR. RENZE: And is that because the data that are collected or the runway surface conditions that were tested are more limited than this set or for some other reason?

MR. BOCCANFUSO: It's because of the device. I think this set also incorporates the various devices if I'm not mistaken.

DR. RENZE: Okay. Thank you. Mr. Boccanfuso, why doesn't CRFI apply to wet conditions?

MR. BOCCANFUSO: Well, I think it doesn't apply to wet because wet is speed dependent, and whereas the other, the other contaminated surfaces are not affected by speed. So the fact that it's affected by speed, a decel reading would not be viable, would provide erroneous information and similar would apply to slush.

MR. YAGER: Could I add a note to that? One of the reasons wet and dry pavement surfaces are not used with the decelerometer is simply the fact that the test procedure where the operator applies momentary locked wheel braking, in a lot of instances, that just physically isn't capable between the vehicle tires and the dry or wet pavement. And so that introduces variability and non-repeatability in the measurement, and the decelerometer manufacturers themselves caution the operators not to use the decelerometer under those conditions.

DR. RENZE: Mr. Boccanfuso, you noted during your presentation that in terms of constraints on use or acquisition of measurements, that you could take measurements on an icy surface with slush on top of the ice, and I'm curious to know why you can do that but you can't take measurements on a, for instance, concrete surface where slush is the only contaminant with no other type of contaminant present?

MR. BOCCANFUSO: The reason you can take it on surface with -- on a slush -- on an ice -- slush covered ice surface is, again slush being a very thin film, is because being a thin film you break through the slush and actually be measuring the ice surface rather than the slush contaminant, whereas if you didn't have the ice, then there's other factors that come into play such as drag and some other issues that Tom was talking about.

DR. RENZE: Okay. Mr. Yager, could you clarify for me with respect to continuous friction measurement devices, are there surface conditions that you can quantify with those devices that you cannot quantify with decelerometer devices?

MR. YAGER: Yes. We can -- with probably better accuracy than on snow and ice, we can get better friction readings under wet conditions, and a lot of the vehicles are equipped with a self-wetting feature that provides a 1 millimeter water depth in front of the test tire on each and every run. And over in Europe, they use a different water depth system, and that's one of the issues we have with ICAO or not ICAO itself but to standardize the wetting procedure used by these different devices in different countries. But, yes, the other -- the surface friction test or the mu meter, the grip tester, the runway friction test are all -- all can adequately and repeatedly measure wet surface friction whereas the decelerometer cannot.

DR. RENZE: Okay. Mr. Boccanfuso, you had a slide in your presentation that shows for snow less than 3 millimeters. There may be a range of CRFI measurements that might be associated with that, and I was just curious why snow less than 3 millimeters produces such a large range of potential measurement?

MR. BOCCANFUSO: Well, in our data set, we conducted -- we have about 14 -- we tested 14 different snow covered surfaces with various ranges, and we conducted 51 runs and essentially that was the range. Now the exact reason as to why, I don't have that expertise to be able to tell you that.

DR. RENZE: Okay. Mr. Yager, you noted during your presentation that, that during a snowy condition, you could take a measurement at say 10:00 and then take a second measurement at 10:15, and those measurements could change. Do you have a recommendation for operational practice for how frequently you might need to take measurements during a transient or steady state weather event?

MR. YAGER: Well, it's been my experience that most weather events are transient, and consequently it's good to establish the onset of the event, what the friction level is and then depending on the best established weather predictions, at least do it on an hourly basis. Otherwise, due to accumulation of contaminant on the runway, the airport operators I'm sure would have the expertise to identify when that particular runway ought to be closed and contaminant removal operations start, and then at the conclusion of the removal operations, a friction measuring set of data ought to be collected before opening it again to normal aircraft operations.

It's curious in my experience testing different airplanes, we looked at a 737 operating on a wet ice surface up in Brunswick, Maine, and I was in the jump seat on that particular run. We entered the test surface at 97 knots. It was 1500 feet long, and we came out at 91 knots. And the sensation I had on the rear part of my pants was that we actually speeded up when he applied brakes on that wet ice. There was no sensation of stopping, and yet on the same token, that airplane went through a 1500 test section with 6 inches of snow on the runway and due to the contaminant drag, we didn't apply brakes, but due to the contaminant drag measurements on the airplane, he would not have been able to take off on that 10,000 foot runway with that type of drag on the condition.

And I guess what I'm getting to is that the variability and the amount as well as the type of contaminant can appreciably influence the friction level and the stopping performance of airplanes.

DR. RENZE: Thank you. Mr. Marinelli, does the FAA provide any guidance regarding the frequency that measurements might be taken if they are taken during a transient weather event?

MR. MARINELLI: We do provide some guidance but it's not based on a time value. It's based on changing weather conditions. So our guidance would say to take another friction measurement anytime conditions change.

DR. RENZE: If FAA recommends providing pilots with both the friction measurement value and the friction measurement device type used for that value, what does the FAA believe that a flight crew should do with that information?

MR. MARINELLI: We believe it's just another data point that the pilot can use in decision making. The present guidance as it stands, giving the name of the device and the friction readings, was as a result of our conversations with private organizations and that was that they desired to receive.

DR. RENZE: Okay. Thank you. Mr. Geisman, could you briefly describe what Boeing's role is in the Joint Friction Program?

MR. GEISMAN: On the performance side, we have not had any direct role in the Joint Friction Program. Early in the program, we did have an observer from the mechanical systems side looking at the way the friction vehicle operated.

DR. RENZE: What are Boeing's concerns, if any, about the use of the Canadian Runway Friction Index for performance calculations?

MR. GEISMAN: Okay. The concerns come with any friction index, that as we've seen the variability in both time and in the measurement variability, both are there. So the CRFI is a measure of friction as measured by a device, and so the concerns are just some of the things you've heard today from the other panelists on that.

DR. RENZE: What does Boeing recommend if reported braking action is poor?

MR. GEISMAN: We don't have a specific recommendation in the airplane performance outside of the performance numbers that we supply, you know, in the documents. We do supply some information in the flight crew training manual on crosswind guidelines with very poor runways that indicate very, very low crosswind capability.

DR. RENZE: Nick, can we bring up the slide from the Boeing presentation please?

Mr. Geisman, on this slide which I think is a good summary of the information available, what in your opinion is the best information available that a flight crew should use to make a decision regarding completing the landing safely?

MR. GEISMAN: I do not have expertise as a pilot in the evaluation or the decision making process, but the basic position is the pilot should use all the information that he has available to him, but again, I'm not a flight crew and do not have experience in making that decision.

DR. RENZE: Does Boeing provide any guidance on what a flight crew should do with conflicting information?

MR. GEISMAN: We do not have in any of our publications a direct statement on what to do with conflicting information. We do in our classes discuss conflicting information and again, it's up to the operator's position or whoever we're talking to, on what their specific issues are with that.

DR. RENZE: You noted in your presentation that the Boeing quick reference handbook data are on the conservative side for compact snow and ice. If that's true, why do operators need an additional margin for their performance calculations?

MR. GEISMAN: Okay. There are many things that affect the landing operation, and in our documents, we recommend that the operators evaluate their operation, things like touchdown point, what landing aids are available, how accurate the information they think they have, and then with that evaluation determine what additional margin that they think is necessary. And so again, there's many other things than just the runway friction part, or excuse me, the runway condition that gets into the landing distance on that.

DR. RENZE: Thank you. Mr. DeGroh, what percentage of pilots believe that all landing performance calculations exclude the use of reverse thrust?

CAPT. DeGROH: I would almost have to say the majority of the pilots don't think reverse thrust is included in the runway performance calculations.

DR. RENZE: What education is ALPA providing the pilots to attempt to differentiate airplane flight manual data from operational landing data and, for instance, this reverse thrust issue?

CAPT. DeGROH: That's a good question. ALPA has been traditionally I think a little bit out -- standoffish with regards to training issues, not wanting necessarily to get in the way of an operator's training program. However, if issues are strong enough, ALPA does have the ability to communicate with flight crews regarding specific areas of aircraft operation through bulletins out to the general membership, but I'm not aware of a specific educational program in this -- on the subject specifically.

DR. RENZE: Okay. What does safety margin mean to a pilot?

CAPT. DeGROH: Gravy. It gives me something extra that I can hang my hat on. I mean there should be, there should be layers of safety such that any single failure doesn't result in a catastrophe. You shouldn't be backed into a corner so that if any one thing fails, you have nowhere to go. I mean a common phrase among pilots is try to always leave yourself an out, and that's where margin comes in. I mean with respect to the thrust reverse issue, when does a pilot find out his thrust reverse doesn't work, once when he needs it, he tries to deploy it. So there needs to be some margin beyond the end of the runway perhaps or safety area, or other safety margin perhaps in distance to account for those unexpected occurrences.

DR. RENZE: Okay. I have a follow up to the question that I posed to Mr. Geisman about conflicting information for the Airline Pilots Association. In your experience, how do pilots evaluate conflicting information?

CAPT. DeGROH: I think a lot of pilots would tend to take a look at the information and most likely tend towards the most conservative, the most restrictive piece of information because again, if you do that, it buys you margin on the other issues.

DR. RENZE: Thank you. And with respect to the FAA notice 8400.C082, in your opinion, how will that notice affect pilots?

CAPT. DeGROH: Well, that came out in the Federal Register, and we, ALPA, want to formulate a formal response. So I'd rather not probably get into that at the moment just so that we can have a formal response to that document.

DR. RENZE: I understand. Thank you. That's all I have.

CHAIRMAN ROSENKER: Thank you, Dr. Renze. Dr. Lemos, did you have any questions?

DR. LEMOS: No.

CHAIRMAN ROSENKER: Captain, did you have any questions?

CAPT. KIRCHGESSNER: I have no questions.

CHAIRMAN ROSENKER: Okay. Very good. Did you want to have a question before we move to the parties? Okay.

We'll start with Southwest Airlines. Do you have any questions?

MR. LOGAN: Mr. Chairman, we have no questions.

CHAIRMAN ROSENKER: Thank you. Southwest Pilots Association, any questions?

CAPT. HEFNER: Yes, sir, Mr. Chairman. We have just a few here.

CHAIRMAN ROSENKER: Certainly.

CAPT. HEFNER: Mr. Geisman, are you familiar with the performance group study and the work that they did while up at Boeing and on this particular accident?

MR. GEISMAN: Sir, I'm familiar with part of that.

CAPT. HEFNER: Are you familiar with the effective braking mu value that was determined in that study?

MR. GEISMAN: I am familiar with part of what they did to get the airplane braking coefficient in that study.

CAPT. HEFNER: And do you recall what that was?

MR. GEISMAN: It's actually documented quite well if you want in page 8 of the document and --

CAPT. HEFNER: I can't pull it up on my computer unfortunately. I had a little malfunction over here.

MR. GEISMAN: Okay.

CAPT. HEFNER: Was that value an .08?

MR. GEISMAN: I'm sorry.

CAPT. HEFNER: Was that value .08?

MR. GEISMAN: What value, sir?

CAPT. HEFNER: The braking mu?

MR. GEISMAN: For the accident airplane?

CAPT. HEFNER: Yes, sir.

MR. GEISMAN: I believe that is correct.

CAPT. HEFNER: Thanks. I just wanted to verify that because I couldn't pull it up here. Thanks.

For Dr. Yager, the Beaumont meter was run down the runway after, approximately four to five minutes after the accident aircraft, came back with mu values of 41, 40 and 38, effectively an average of 40. With the performance group calculated braking effectiveness of the accident airplane of an .08, can you help us understand the difference in those two values?

MR. YAGER: Yes. You can't expect a 1 to 1 relationship between the ground vehicle measurement and the airplane measurement. There's too many other factors influencing both of them, and that's why we've gone to this International Runway Friction Index, to help eliminate some of the ground vehicle variables and go more directly towards the airplane effective mu. A .4 with a decelerometer is considered fairly good, and I would expect the airplane on that basis to give a value in the order of .25 to .3, not .08, and there's several factors that can play a role in that differentiation between what the airplane actually developed and what it should have developed. One of the things is applying the brakes. Another one is the condition of the tires. A third one is the actual path of the airplane down the runway versus the path of the decelerometer device which is normally 3 meters off the center line the whole way down the runway. So it might have been a case of the airplane seeing different conditions than what the ground vehicle saw.

Secondly, it could be that in the course of taking the measurements, the ground vehicle did not maintain uniform test conditions for each of the one-third runway measurements, and that could have influenced the value.

And then, third, the type of tires the ground vehicle had on its vehicle, and how it performed under the continuing changing precipitation levels of the snow. So I'm not surprised that there's that much difference between the airplane actual braking performance and the ground vehicle measurement. It's just such that we need to better fine tune our measurements of the ground vehicle device to relate more directly to the airplane.

CAPT. HEFNER: Thank you, sir. And now for Mr. Marinelli. Apparently from what we're hearing this morning, the IRFI and the CRFI seem to provide a level of reliability that we don't have in our United States systems, and why has the FAA -- can you elaborate why the FAA feels it is not applicable to United States airports?

MR. MARINELLI: Again, I'm going to have to defer that question to a college, Mr. Stimson because I have little expertise in aircraft performance and I couldn't tell you why the numbers don't relate to aircraft performance but in this situation, it obviously did not.

CAPT. HEFNER: Okay. Thank you, sir. And back to Dr. Yager. You're familiar with the Type IV deice, anti-ice fluid that is applied to wing surfaces prior to departure.

MR. YAGER: Yes. In fact, I was involved in a study at Chicago O'Hare about 10 years ago looking into that higher viscosity chemical.

CAPT. HEFNER: And that chemical typically sloughs off in the neighborhood of the V1 speed where the airplane wing starts to develop lift.

MR. YAGER: That's correct.

CAPT. HEFNER: It does not carry it into the air and obviously it has to come back someplace and it's there on the runway. Would that Type IV fluid underline a wet, snow surface, have any effect on the friction component?

MR. YAGER: It was my experience in the Chicago O'Hare experiment that, no, it would not. Now admittedly, when we did the experiment at Chicago, it was a bare, dry runway. It wasn't any snow contamination coming down. The temperature was in the order of 25 degrees, and we put it on 10 different airplanes, wide bodies as well as narrow bodies, and it was all

-- and we put green food coloring dye in it so that it was visibly evidence as the airplane taxied by our location. But the change in friction on that bare runway was less than 1 percent after 10 airplanes took off.

Now admittedly, if there was already snow on it, and some of that contaminant came off the wing, I don't have a knowledge of how much it would affect the friction level.

CAPT. HEFNER: Thank you, sir.

MR. YAGER: By the way, it's Mr. Yager, not Dr. Yager.

CAPT. HEFNER: Oh, I'm sorry. I thought you were a doctor.

MR. YAGER: Thank you.

CAPT. HEFNER: And for Mr. Marinelli. As far as certification of Part 25 aircraft, can you speak to that?

MR. MARINELLI: Not at all. I'm sorry.

CAPT. HEFNER: Okay. All right. Mr. Geisman, are runway frozen contaminants taken into accord in any portion of the Part 25 certification for transport aircraft?

MR. GEISMAN: In runway frozen contaminants? They're not taken into account for performance calculations in Part 25.

CAPT. HEFNER: SWAPA has no more questions. Thank you.

CHAIRMAN ROSENKER: Thank you very much. City of Chicago.

COMMISSIONER FERNANDEZ: Mr. Chairman, the City of Chicago does not have any questions of this panel.

CHAIRMAN ROSENKER: Thank you, Commissioner. Boeing.

MR. SMITH: I have one question for Mr. Boccanfuso. Your chart on the CRFI index showed examples using runway friction numbers of .4 and .28. According to the NTSB factual reports, the Beaumont friction test run prior to the accident which was the value in force at the time of the accident was .67, could you relate or tell us what that information would have told the land flight crews if it had been relayed to them?

MR. BOCCANFUSO: What the .67 would have meant?

MR. SMITH: What would that have meant to a landing crew if it had been relayed to them?

MR. BOCCANFUSO: .67 is bare and dry. It's very good braking. But one of the things I'd just like to add to that though is that during our testing, there is a range based on the description of the surface. There is a range of friction that goes from .16 to .7 I believe. It was in my previous charts. .67 may have been within that range.

MR. SMITH. Okay. Thank you. No further questions.

CHAIRMAN ROSENKER: Thank you very much. The FAA please.

MR. WALLACE: Thank you, Mr. Chairman. Just a few questions.

Mr. DeGroh described -- I don't have a question for you but I appreciate it, described a state where we would have accurate and timely friction measurement reports which correlated well to the performance of the aircraft, and I think we all agree that that would be the state that we strive for, but I also recall Mr. Boccanfuso talking about the need for us to take the science and turn it into practical tools.

One question I have and I'm going to address it to Mr. Marinelli initially, and anyone else can answer, how long does it take to do a runway friction test, and I'd ask if you'd speak to both a continuous measurement and the decelerometer measurements on a typical runway? Let's take this runway which was 6500 feet long. What would be a typical time span to accomplish such a test?

MR. MARINELLI: Well, a winter runway friction test can be conducted anywhere from say 20 miles an hour to 40 miles an hour. So let's take an average of 30 miles an hour would be 2 minutes per mile. If the runway is a mile and a half long, it should take about three minutes to get from one end to the other. With a decelerometer, it requires multiple stops, 9 to 10, each stop probably takes about 15 seconds or so. So it would be several minutes for a decelerometer.

MR. WALLACE: And I recall Mr. -- I believe Mr. Yager saying that you want to measure at least once per hour. Well, there was different answers. I'm just trying to see how we can zero in on the practical approach in an airport environment where we are landing aircraft on two minutes in tail separation typically in a high capacity situation, and this is not a capacity -- the capacity issue is linked with the safety issue because airplanes have to go someplace in rapidly changing weather.

May we bring up slide 11 from Mr. Geisman's presentation again?

I'll just go ahead and start the question. The question is for you, Mr. Geisman. The -- I recall that the data showed the test which was done before the accident with a .67 reading, I actually could not read the second test, and so I cannot see from where I'm sitting the value derived in the second test, that is the test following the accident. Can you tell me what the value is?

MR. GEISMAN: The average value was 40.

MR. WALLACE: 40.

MR. GEISMAN: Yes.

MR. WALLACE: So if I recall, I believe it was Mr. DeGroh's presentation that the 40, the .4 is going to equate to somewhere in the fair to poor -- I mean fair to good range. Is that correct?

MR. GEISMAN: Yes, just as Mr. Yager said just a few minutes ago --

MR. WALLACE: Okay. So --

MR. GEISMAN: -- that would typically be the interpretation.

MR. WALLACE: The .4 is fair to good and the .67 prior to the accident equates to I believe Mr. Boccanfuso just said a dry runway essentially. And then we have 4 pilot reports in a row. Is that correct? That all include a value of poor at least the low end.

MR. GEISMAN: That's a correct statement. They weren't in a row. There was two that did not report, but there were four pilots.

MR. WALLACE: So what you conclude is the more accurate measurement of how that -- how the accident aircraft actually performed.

MR. GEISMAN: I think the accident aircraft is as shown with the FDR. That's how the accident aircraft performed. That's based on the data from the analysis by the performance study group and that --

MR. WALLACE: Are you --

MR. GEISMAN: -- data.

MR. WALLACE: Would you be able to speak to the conservatisms that would be the margin that is that would be derived in the performance calculation based on the point .67 value? In other words, would this aircraft, if according -- if the .67 value had correlated as the CRFI tables would indicate, could you tell us what that would mean in terms of a landing distance margin?

MR. GEISMAN: I'm sorry, sir. I'm not sure I understood the exact question you're asking.

MR. WALLACE: I've seen calculations that you guessed that at .67 the aircraft would have had 1,000 foot or so landing margin.

MR. GEISMAN: I have not done a calculation on the accident to show what the dry runway distance would be with the actual, but it certainly could be calculated. The performance study does have some that information in it, and I don't remember the exact numbers.

MR. WALLACE: Okay.

MR. GEISMAN: But it is in the performance study I believe.

MR. WALLACE: Just one final question again for Mr. Geisman. Mr. George -- is Boeing involved in any research efforts relating to technology which might then -- which might allow for the down linking or transmitting of the deceleration data from landing aircraft to be used to be conveyed to aircraft approaching?

MR. GEISMAN: I'm not aware of any studies on that. There are various studies going on at Boeing all the time, and I'm not aware of any specific study on that issue.

MR. WALLACE: Okay. Thank you. Nothing further, Mr. Chairman.

CHAIRMAN ROSENKER: Thank you very much. I'll now turn to the Board of inquiry. Dr. Ellingstad?

DR. ELLINGSTAD: Thank you. Just a couple of questions to Mr. Boccanfuso regarding the practices in Canada. How many airports are you using the CRFI measurement?

MR. BOCCANFUSO: Right now all airports are using the CRFI system, and they're all using decels during wintertime operations.

DR. ELLINGSTAD: Okay. And you mentioned that the principal application is under contaminated surfaces. Is there a protocol that dictates when these measurements are going to be applied?

MR. BOCCANFUSO: Yes. As I listed in one of my slides, during wintertime operations, under certain surface conditions, the CRFI system is used and essentially it's a decelerometer that's being used during the wintertime on their contaminated winter surfaces.

DR. ELLINGSTAD: Okay. And does that protocol dictate your frequency of replication, how often you do it or is it --

MR. BOCCANFUSO: Yes, well, we have various advisory circulars that tell us prior to a shift when there's a change in conditions, if there's chemical being applied, we go out and we measure runway friction measurements.

DR. ELLINGSTAD: Okay. And you had mentioned in response to Mr. Wallace about the time it takes. Is it feasible with the system that you're using to develop and report measures for segments of the runway both from a practical measurement point of view and from a time point of view?

MR. BOCCANFUSO: Right now, if my memory serves me right, it takes about 8 to 9 minutes with a continuous friction measurement device which goes up and down the runway, but with a decel device, it would take between 3, 4 minutes -- 3 or 4 additional minutes using the CRFI system.

DR. ELLINGSTAD: What I'm trying to get at, it had been pointed out earlier that some pilots would prefer to have measurements reported, you know, in thirds of the runway or this sort of thing. Now my question is, how much does that complicate the measurement and the reporting? How much time would it add?

MR. BOCCANFUSO: With respect to the third of the runway, that's a very good suggestion, and I believe we're in the process of revising our -- right now since we don't report the thirds of the runway, one of the things that we do that is not currently done in the U.S., in our aircraft movement surface condition report, there is an area under observations that actually indicates where the contaminant is on the runway. So even though you're not getting the third measurement across with your surface description, you are getting an indication of where the contaminant is, but we are revising that to indicate a third of the runway similar to what is being done in the States.

DR. ELLINGSTAD: Thank you.

CHAIRMAN ROSENKER: Thank you, Dr. Ellingstad. Mr. Clark.

MR. CLARK: Sure. I just have a couple of questions but I'd like to bring up the figure, too, from Mr. Yager's presentation. A lot of the discussion here has been about scatter in the data and the data you present does show a certain amount of scatter and you gave us some ideas of what the scatter meant. Can we cut that scatter down to a single runway friction measurement device?

MR. YAGER: Yes, we can but I think the biggest variable here is that in testing these five different airplanes, they were not all at the same location, nor under the same temperature conditions, and hence that influences the magnitude of the aircraft friction coefficient versus the IRFI.

MR. CLARK: Would that be a problem out in the operational world by definition?

MR. YAGER: That's correct. It would be a problem in the operational world, and that's why we've gone to this International Runway Friction Index. I think it eliminates a lot of those other variables in the ground -- measurements and we can apply the IRFI with better accuracy to the aircraft braking coefficients.

MR. CLARK: Okay. But part of the IRFI is also to normalize all the different friction devices out there. Is that really possible?

MR. YAGER: We've proven it to be possible within plus or minus 5 percent. We've looked at not only the different types of devices, but within the same type of device, we've looked at up to six different devices such as the grip tester. We've evidenced six different ones to give us a constant IRFI value.

MR. CLARK: And then part of that scatter, you mentioned that it was due to the timing where you would take a test, make several flights or landings, do another test but that's also part of the real world out there.

MR. YAGER: That's true. That's true. And, of course, in the real world out there you can't do a test before and after each airplane operation, and from an R&D standpoint, that was the only approach we could see that would give us a viable, useful results and that's the reason we did it that way.

MR. CLARK: Now one thing I see in the graphs here, the 757 data, the blue data, that looks pretty consistent for whatever test data you have here, take all the other airplanes out, let's look at the 757 and I don't know what equipment you used to measure those but for the blue data up there, that looks pretty consistent to me.

MR. YAGER: Yeah, that data was collected up near Marquette, Michigan, and we had a fairly steady weather condition the week we were up there. The temperatures didn't change very much.

MR. CLARK: Okay. But if the temperature had changed, would those values move around?

MR. YAGER: Well, they would in the sense that they would -- if the temperature went up, they would -- the values would have been lower, whereas if the temperature went down, got colder, the friction IRFI values would have been higher.

MR. CLARK: Well, okay. Let me ask it this way. So if the IRFI number is going up and down, would not the actual aircraft mu be going up and down or is that scatter that we're talking about?

MR. YAGER: No, that would be reflected in both devices, the airplane and the ground vehicle.

MR. CLARK: So you'd be moving up and down that line --

MR. YAGER: Right.

MR. CLARK: -- in a consistent manner.

MR. YAGER: That's correct. That's correct.

MR. CLARK: The -- for the -- if we were to break these down by aircraft or by friction measuring equipment, I'm still intrigued by limiting the number of types of devices out there which would certainly help the scatter or I guess what you would shoot for is that every device be well known and any airport could use whatever device it chose within an acceptable range. For this kind of scatter that we're seeing out of this data, in your experience, is that better or worse than the kind of scatter we would get out of pilot reports?

MR. YAGER: I'm of the opinion that it's better, and something on the basis that we have quantitative numbers to deal with rather than subjective assessments of the runway condition.

MR. CLARK: I don't know that we need to bring up, I think it was Mr. DeGroh's slide, but -- or no, it was Mr. Geisman's slide, that showed a lot of scatter in the pilot reports just -- the same pilot giving quite a scatter in the data. It would seem that if we could get more consistency, would we not buy ourselves some margin?

MR. YAGER: Definitely, and I think that's part of the impetus driving this need to have calibration centers for the ground vehicle devices.

MR. CLARK: Mr. Geisman, you put that data together on the other chart. Do you -- what's your view on the pilot reports?

MR. GEISMAN: One of the ones that you're talking about specifically was good in the first part of the runway and poor at the end of the runway. So it was reflecting -- that's not scatter. That's reflecting different capability at different parts of the runway, also potentially opinions based on other factors get involved there but the data from that particular day, on that particular operation, showed mostly in the fair to poor range.

MR. CLARK: And I think from one of your slides, one of the things you did want to point out is that the friction measurement equipment was way outside the norm. The pilot reports were a lot closer to the data we've backed out from the FDR data.

MR. GEISMAN: At the time that the pilot reports were taken, they seemed to agree with the FDR data more than the earlier friction reading, yes.

MR. CLARK: Mr. Yager, have you looked at the -- those friction measurements were inordinately high, and I think you spoke to that a little bit earlier, some of the reasons perhaps why they were particularly high, compared to what the pilots were sensing and compared to what we could back out of the accelerometer data on the FDR.

MR. YAGER: Right. I have not seen the actual vehicle and decelerometer that was used at the airport facility, and I'm at a loss today as to give you actual variables that could have contributed to the difference between what the ground vehicle measured and what the airplane measured. All I can do is make some assumptions, and --

MR. CLARK: All right. Mr. Marinelli, you've talked, FAA is certainly reluctant to embrace this concept and put it into use now but for example, this graph to set this figure to, for the scatter and the data, could you not just normalize the line downward slightly and all the scatter would be on the conservative side? Wouldn't that be an acceptable method to give our pilots the best information out there?

MR. MARINELLI: I suppose you could do that but there's an economic cost to diverting flights that probably don't need to be diverted. I'm not sure how much you have to skew that line down in order to make it conservative enough.

MR. CLARK: Well, I don't know how to compare that economic cost against an airplane off the end of the runway. That's my difficulty right now. And I don't know whether we're going to get into it but we're making downwind landings when we could have bought a lot of margin making an upwind landing. So there's an economic cost of not disrupting Midway. So I guess we're talking a lot about safety here as long as it just doesn't disrupt certain operations that seem to be somewhat sacred. So if I were to drop that line down, you're suggesting that there would be a number of flights that could not land because of the performance calculations or they'd have to take other means such as not take downwind landings or watch their weight. All of that I assume is --

MR. MARINELLI: Well, again, I’m not an aircraft performance person. So I really can't speak to that directly.

But, you know, I'm not sure how much you'd have to adjust that number of .67 down to where it would have made sense on this flight.

MR. CLARK: Well, I think the .67 is -- that's a big unknown. That's an issue with the friction measurement equipment that for right now to get consistency for whatever the Canadians are doing, they're getting a lot of consistency they believe and I think the work needs to go on on that. The consistency for the measurements and then my question is how good does that scatter have to be. We're never going to be perfect on this. But take your data, drop that line a little bit by your margin, that's what we need to do, and --

MR. MARINELLI: I'm not sure that's the solution, but it's certainly something we're willing to look at.

MR. CLARK: All right. Thank you.

CHAIRMAN ROSENKER: Thank you, Mr. Clark. Mr. Benzon.

MR. BENZON: I have nothing, sir.

CHAIRMAN ROSENKER: Okay. I just have a couple of questions before we release this panel and let me thank you for your outstanding presentations and your very thoughtful answers to the questions. We appreciate that very much.

I'd like to talk to Mr. Boccanfuso please, talk a little about the experience that you've had since you've begun looking and using the -- do you call it CRFI or CRFI?

MR. BOCCANFUSO: CRFI, sir.

CHAIRMAN ROSENKER: CRFI.

MR. BOCCANFUSO: Well, when we initially started the program, we thought -- we didn't think we were going to be able to have -- we didn't know about all the problems were we actually going to encounter. Some of the equipment varied quite substantially, even the same makes and manufacturers, bought at the same time. Some of the tests we conducted, there was a great variation. So in terms of our Canadian experience, we had to pass what we call a JBI index, JBI system that we used way back when. So we used the opportunity of the Joint Winter Runway Friction Program to solidify some of the data that we've had in the past, and by doing that, it certainly raised the level of confidence in the pilots because every data point on that chart has been gathered as a result of the testing done over the past seven, eight years.

So although there still is different decel devices that are currently being used in Canada, and there is slight variation between the decel device overall, just for those particular surfaces, we feel quite confident that what we're using is right now, even though it's not an exact science, probably the best thing out there.

CHAIRMAN ROSENKER: How about actual operational experience, results, reduction in runway overrun?

MR. BOCCANFUSO: I don't have that figure. We did a cost benefit analysis that I maybe could provide to the Court. I don't have that figure currently.

CHAIRMAN ROSENKER: That would be interesting. Perhaps you could submit that later for the record.

MR. BOCCANFUSO: I will.

CHAIRMAN ROSENKER: Thank you. And also if you noticed any increased diversion.

MR. BOCCANFUSO: Well, one of the things with the CRFI, there is a certain amount of conservatism built in. So an operator that does choose to go just with the CRFI system may experience more diversions than they would with another otherwise less conservative system, but really that's -- this is why it's advisory material and we leave it up to the operators to make that decision.

CHAIRMAN ROSENKER: Thank you. And if I could just ask for just a moment, Mr. DeGroh, talk a little about -- you indicated the subjectivity and clearly we spent a lot of time dealing with the issue of subjectivity of a pilot's characterization of what the conditions are. How do you make that decision? How do you decide? Is that kind of a consensus between you and the first officer, the captain and the first officer? How do you come up with that characterization?

CAPT. DeGROH: Well, most likely it would be an assessment made by the pilot actually handling the flight controls, and it's made oftentimes based on experience. As I said before, if you get a pilot who is flying in conditions -- in winter conditions he's not used to, he may tend to be a little more conservative in his braking action report than one who is used to those conditions. So it really is dependent I think on pilot experience and comfort level and again, perhaps is a reason why there may be -- it might be useful to have some other guidance in general terms to assist pilots in selecting a more appropriate term that perhaps might be a little more consistent.

CHAIRMAN ROSENKER: Now when you hear, as you begin your approach and begin your landing, do you change any of your procedures or perhaps technique any when you hear that it is fair to poor, that type of thing?

CAPT. DeGROH: Certainly. I think what we look at or at least what I look at if the runway is being reported with less than dry conditions, we're going to look at where our plane touchdown point is going to be. We're going to look at making sure we are on speed at the 50 foot point, typically V rev or however that particular airline has a speed additive perhaps and make sure the aircraft is properly configured, and if you have autobrakes that's armed and spoilers armed, you're going to try to grab that first brick possible. So, yes, you may tend to be a little less stringent in your planning on a purely dry runway and pilots are taught, you need to land in the touchdown zone, and typically that's the first 3,000 feet as marked out on the runway. But when you're faced with slippery, contaminated wet runway, you tend to be a little bit more cognizant where the touchdown point's going to be.

And, I might add, it's important on any advisory data or if we can ever get to certified data on these contaminants, that the assumptions used be forwarded to the pilots. Some of the assumptions might say, this assumes that the touchdown is going to occur at 1,000 feet. Well, that needs to be made known to the crew so they know that they don't have that full 3,000 feet available. They need to make sure they work for the 1,000 foot, and where the touchdown point may be with an auto land system. All those assumptions need to be made available to the crew in order that they can realize the data that they're looking at.

CHAIRMAN ROSENKER: Thank you very much, Mr. DeGroh, and I will also ask that question to Southwest and the Southwest Pilots Association so they may be prepared for the same type of question. Thank you very much.

Let me excuse the witness panel. Again, I thank you so much for your presentation and what you've been able to contribute to this inquiry today.

We will take a 7, make it 8 minutes. I'll try to begin again promptly at noon, and we'll try to go for around 30, 40 minutes, and then we'll try to get a lunch break and reconvene, and we will try to get as many panels in as we possibly can today. Thank you.

(Off the record.)

(On the record.)

CHAIRMAN ROSENKER: Thank you for being here, Mr. Rodriguez. Your presentation.

MR. RODRIGUEZ: Thank you for inviting me, Mr. Chairman.

CHAIRMAN ROSENKER: Thank you.

(Whereupon,

ALBERTO RODRIGUEZ

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

MR. RODRIGUEZ: Good morning. I'd like to begin by providing you with a brief overview of Midway Airport, followed by some insight into how we approach snow removal operations.

Again, my name is Alberto Rodriguez. I'm the Chief of Operations at the Department of Aviation at Midway International Airport.

Midway International Airport is known in many circles as aviation's busy square mile. We are currently configured to provide five runways, two of which are available for air carrier operations. Our longest runway spans 6,522 feet. We have three precision approaches into Midway at this time.

CHAIRMAN ROSENKER: Hang on for just a second. I don't believe your think is on the screen.

MR. RODRIGUEZ: Okay. There we go.

CHAIRMAN ROSENKER: Thank you.

MR. RODRIGUEZ: I'll just move onto the next slide. In 2005, Midway Airport accommodated nearly 285,000 aircraft operations, serving approximately 17.8 million passengers. Ten airlines serving more than 55 domestic and international destinations call Midway home, and I also want to point out that we have received a no discrepancy rating by the Federal Aviation Administration during our annual airport certification inspection for the last 10 years in a row, and most recently of which was this year in May of 2006.

Our snow removal plan is based on the standards that are provided by the Federal Aviation Administration, and in specific, Federal Aviation Regulation Part 139, as well as the advisory circular on airport winter safety and operations. Our goal is not only to comply with but also exceed these standards. We consider our snow removal process an ongoing, year round process that can be divided into these three categories, planning, preparation and execution.

At the end of the previous year's snow season, really marks the beginning of our planning and preparation phrase. During this process, nearly everyone at the airport who has a stake and/or role in the success of our snow removal operation is involved. Over the course of the year, we do a lot of proactive activities and continually follow industry advancements as well as new technologies that could further enhance our operation. An example of this new technology is the electronic log system which I will expand on a little bit more during my presentation.

In order to maintain our proficiency, the airport staff undergoes an extensive recurrent training and procedure review process. Typically we invest in an average of 40 hours of training per employee prior to the first snow event. As you can see by the slide here, we have an adequate amount of staffing as well as equip to address any of the winter challenges that we might meet.

This brings us to the implementation of our practical or more so the effective application of our efforts, and basically what happens here is we begin by implementing our snow plan. A unique and particular item of our snow plan is the fact that we have an airport operation staff member positioned in the aircraft control tower to facilitate the efficient and safe movement of our snow removal teams in conjunction with the air traffic. Although this is not a required option, this is something that presents a very beneficial process by which we can facilitate the snow removal operation. And he also serves as an additional source of airport condition information to the air traffic controllers.

In assessing our current and expected meteorological conditions, the airport takes a toolbox approach to obtaining this critical information. We take into consideration a multitude of meteorological weather sources. We review and compare that information to try to arrive at the most accurate estimate of what can be expected. The information that we obtain from all the different weather sources addresses both ambient and surface temperatures and variables, as well as on the local and national scope of the overall operation.

We even have a -- program which enables us to superimpose or follow Midway specific traffic in relation to the current radar imagery.

In determining runway conditions, we use multiple tools. We never rely on one particular variable. What you see here is some of the items that we take into consideration. What we have found is that friction surveys and our visual inspections or physical inspections of the runway tend to be the least subjective and the most factual.

The Federal Aviation Administration offers similar guidance in this respect. Federal Aviation Advisory 150/5200-30A specifies guidelines for when to conduct friction surveys, and these are done primarily for the benefit of the aircraft operator. We both meet and exceed these standards and, in addition to doing that at a minimum, we also conduct the standards to provide us with the most up-to-date accurate picture that's possible. So we're actually on the runway quite a bit.

In addition to the publications by the FAA, many other industry standards also recommend the use of friction surveys. I believe that many of the airline flight operations manuals as well as the Airline Pilots Association recommend the use of friction surveys.

There are two basic types of FAA approved devices. Midway utilizes both types, and we actually own two of each type. Our staff is very conversant with this equipment as it is utilized year round, and what is beneficial about these devices to the airport is that they are self-calibrating and contain an on-board diagnostic computer system that pretty much eliminate the potential for human error.

After obtaining this information, the question becomes or the issue becomes how to get this information in a timely and effective manner to your end users, be it the air traffic control tower and aircraft or aircraft operator inbound to the airport or outbound of the airport. How we do this is the Department of Aviation implemented the electronic log system back in 2002, and this system, what it does is it enables us to provide instantaneously the information that is obtained from a current runway condition assessment or an airfield condition assessment, and in addition to friction data, we also have information in respect to what type of contaminants and how much of a contaminant is on the runway. We also do a supplement to the flight service station NOTAM reporting system. We list our locally issued, our airport issued NOTAMs on the system as well. Some of the information that you would typically see during the winter operation actually touches on some of the items that were mentioned earlier by the Airline Pilots Association representative here, and that is we specify the type of contaminant on the runway, also in relation to percentages, how much is out there, how deep is it, and what type of contaminant it is. And also referenced on that and you can see by the image on the right side, that's where you would see mu numbers which will be broken down by thirds of the runway as well as an average, and that item will also include what type of friction device computed those numbers and then also what time were the friction runs done, and that will all be updated on this airport condition screen.

Some of the users that have access to the website, it's pretty much every tenant at Midway Airport. All the airlines, the fixed based operators. I have a slide here that breaks that down for you a little bit. If you look from top to bottom, once the condition data is obtained, that is instantaneously transmitted via radio to the airport website and also to the Midway traffic control tower. What happens at this point, from the airport website, all the users, the Department of Aviation users, the fixed base operators, the corporate tenants, all airline operations, as well as airline dispatch offices obtain this information. The item that I would like to point out here is that the Midway traffic control tower actually receives the information from at least two different sources. One, via radio communication and, two, via their IDS 4 system. The IDS 4 system is a FAA proprietary computer system that we actually developed the link so that our computer system can speak to theirs and provide that same runway information that all the users are getting to them electronically, and it happens instantaneously. So at the same time the information posts to the air traffic control system, the information is posting to the website which is accessible 24 hours a day to all users.

And the most benefit of the system, and the reason why we're doing this, is in the end, the aircraft is the final user. This is who we want to get the information to as soon as possible so that he can make or she can make their decisions or calculations that they need to arrive at Midway Airport. And that, as you can see on this chart here, the aircraft actually receives it from at least three different sources, either from communication through the air traffic control tower frequencies or through the ATIS information service and then also through the airline dispatch centers.

This brings us to December 8. On December 8th, we initiated a snow alert at 11:00 hours in anticipation of a snow event that was to take place later that afternoon. The heaviest snowfall for Midway occurred between the hours of 17:00 and 18:00 hours where we received 3 inches within that hour. After that time, after 18:00 hours local time, the snow decreased significantly.

In response to this weather, the City of Chicago and the Department of Aviation was conducting continuous runway snow removal operations by brooming, plowing and deicing, or anti-icing I should say. We also activated about 21 additional pieces of equipment that are on call. So what that does for us is by having those additional on-call pieces of equipment at the airport, that pretty much releases all of the aviation specific equipment to address the movement areas. So the 21 additional on-call pieces of equipment were brought out to address some of the terminal ramp areas and gate area locations.

To further emphasize the point here, when we realize that we were going to be getting this substantial amount of snowfall, what we did, we were in a two runway configuration where both runways were available for use. After we seen some information from in respect to the change in the weather forecast, what we did is preemptively position ourselves in a single runway configuration whereby we coordinate with the tower and close the non-ideal runway for use and concentrated on a single runway configuration to maximize our snow removal effort, and that was 31C.

I would like to point out also that that evening, regardless of the snowfall amount or snow rate, there were never more than a trace to a 1/16 of an inch of snow accumulation on any of the primary surfaces, and that I think was a very big plus on the airport snow operations' part.

What we see here is just some excerpts from our snow log and field condition log. Basically it just provides an outline of some of the activities that took place just over an hour prior to the actual accident. You know, essentially again, throughout the whole day, we were doing continuous snow removal operations on the runway and most of our friction surveys were confirming all the information that we were seeing out there visually, that the runway was in acceptable conditions throughout the event, and even during the heaviest portion of the snowfall.

And then again, we never had more than an accumulation of the last field vision report that was sent out to everyone at 18:50 hours, and at that time, we had 90 percent trace, a 1/16 of an inch of snow with the remaining 10 percent of the runway was clear and wet, and that tended to be the condition for most of the evening. We had anti-iced. We used over 12,000 gallons of anti-icing fluids out on the runway, and our anti-icing product has a, has a freezing temperature below negative 75 degrees Fahrenheit, and finally, the other item here on this page that I wanted to point out is again at 19:22

hours, approximately 8 minutes after the Southwest Flight 1248 arrived, our friction average was .40 which is considered good by many aviation industry standards.

In summary, I'd just like to leave you with these points. We do year-long planning in respect to snow removal operations. We meet and exceed all the FAA guidelines on winter snow operations. Again, we have received no discrepancy FAA certification inspection awards for the last 10 years, and one item that I forgot to include in my report here is that Midway is also the recipient of the Colonel Balchen Snow Award for snow removal excellence. Thank you.

CHAIRMAN ROSENKER: Thank you very much, Mr. Rodriguez. We'll begin with our Technical Panel. Mr. George.

MR. GEORGE: Thank you, Mr. Rodriguez. You were on the airfield the night of the accident. Is that correct?

MR. RODRIGUEZ: That is correct.

MR. GEORGE: Can you describe to me and everyone else, where you were when you heard about it, then all of your activities, taking you out onto the airfield, if you actually went out on there, and what you saw?

MR. RODRIGUEZ: I was located at the southeast corner of the airfield. I was actually heading over to the terminal side at that time, and had just gotten that call. So what I did was I immediately turned my vehicle around, traversed the general aviation ramps there directly in front of the air traffic control tower, and joined Yankee taxiway. Once I confirmed my clearance to drive onto the movement areas, I proceeded on Yankee taxiway and took a right turn and headed northeast to 31C. At that point, I jumped on the runway and expedited down to the end of the runway trying to assess where the aircraft location was and I think the visibility was fairly poor. So it was quite sometime before I was actually able to see that the aircraft had indeed penetrated the airport fence.

MR. GEORGE: So you were actually on the accident runway pretty nearly -- pretty soon after the accident?

MR. RODRIGUEZ: Yes, sir. I believe I was the first vehicle followed immediately by the fire department. They caught up with me on the 31C.

MR. GEORGE: How long was it after that, that the friction test was done?

MR. RODRIGUEZ: I want to say roughly about 8 to 10 minutes after that because we were -- I think initially everyone's initial response was to respond to the incident, and en route, one of my other colleagues had called over the radio requesting for a friction test to be done and the individual operating the electronic decelerometer happened to be the closest or in the closest proximity to that runway and he then proceeded to go onto the runway while the remaining airport staff was in response to the actual accident location.

MR. GEORGE: Well, could you describe what the runway looked like to you? What was the -- you were apparently the next vehicle down at what -- describe it to us.

MR. RODRIGUEZ: The runway appeared to me, there was a trace coverage of snow. I didn't have the opportunity to stop and measure it, but I mean it was a very light trace coverage. The pavement markings were still visible to me. I was probably traveling in excess of 50 miles an hour once I was on the actual runway. So I'd say that was about the general condition, I'd say like a trace, you know, of an inch of snow or so.

MR. GEORGE: You could still see the markings through the snow?

MR. RODRIGUEZ: Yes.

MR. GEORGE: What was the nature of the coverage? Was it dry snow, powdery, wet or what?

MR. RODRIGUEZ: The snow on the runway was fairly dry. That, that coincided with some of the earlier forecasts that we had. We were expecting dry snow, and then after the incident, we had actually called to confirm the type of snowfall and one of our meteorological forecasters gave us or provides us with observation data for the Chicago area, and he had told us that the ratio of the snowfall was a 24 to 1 I believe, which is considered a dry snowfall.

MR. GEORGE: We spent sometime earlier talking about slush on runways. Was there slush on the runway?

MR. RODRIGUEZ: No, I would not call that slush, no.

MR. GEORGE: Did you see any ruts from any other vehicles, airplanes included?

MR. RODRIGUEZ: No, I didn't. To be honest with you, I didn't notice any kind of tracking or anything like that.

MR. GEORGE: And this is a subjective question, but you said you were going 50. How slick was it on the runway when in your vehicle?

MR. RODRIGUEZ: I don't, I don't recall it being slick at all. I would say probably no worse than a wet condition on a runway. At the end of the runway it had come, you know, obviously to an abrupt stop. I think it was beyond the -- high seed before I actually saw that an aircraft or where the aircraft had actually come to a stop, and it had come to an abrupt stop and I made a hard right, a 90 degree turn to the right and exited one of the FAA service roads onto the surface to go around some of the debris and try to get over to the aircraft location. So I did not have any problems braking or anything like that.

MR. GEORGE: The snow cover -- one more question about that. You could discern the difference between the runway and off the side of the runway? You could tell. It wasn't a uniform white cover all the way across or --

MR. RODRIGUEZ: There was a trace coverage on the runway surfaces and I'd say that the trace coverage was uniform but it was light in the fact that you could see the markings on there, and then once you got off of the runway edge line obviously or onto the shoulders, then you'd have a little bit thicker coverage in that, you know, you wouldn't be able to discern where the shoulder and the grass area ended or began. So I think that's where you would have but fairly -- on the runway was a fairly uniform coverage of just a trace.

MR. GEORGE: I think you touched on this a little earlier but I wanted you to flush it out a little more. You say that Midway staffs a position in air traffic control tower during snow removal procedures. Could you tell us a little bit more in depth what, what that person does, who they're talking to, and what the rationale for having them there is?

MR. RODRIGUEZ: Sure. The person that we send up there is usually one of our senior airport operations supervisors, and what he does is he goes up there, situates himself usually next to the tower supervisor position just behind. It's a very small tower. So it's just behind all of the local and/or air and ground controllers. What he does is he's up in the control tower with equipment radios as well as the tower ring down phone that we have a direct line to in our office, and what he does is he keeps the air traffic control tower abreast of what we need to do and at the same time coordinates spacing with the air traffic control tower to get our teams out there and try to be, you know, the least disruptive that we can but still, you know, do our job and I think that works very well. What they typically do is we say, okay, 15 minutes from now we're going to want to get on the runway and do a snow removal pass and then we also do a friction run immediately after that. So they would coordinate a gap. So by the time the aircraft prior to our gap arrive, there wouldn't be a huge or any delay for the following aircraft because it had already been coordinated, and he does that, and then in addition to doing that, he also receives the same transmissions that are received in our airport operations office and, and is able to tell the control tower here's our friction numbers, here's the latest field condition information, in addition to the fact that the tower has that information also on their screen. It's just another source to confirm the change in information or just to make sure they are abreast of that information being passed, but he does that, you know, primarily.

MR. GEORGE: Okay. So in the tower, they're going to get the friction measurements just as soon as they're -- as soon as they come in?

MR. RODRIGUEZ: Absolutely.

MR. GEORGE: When you as the airport operator, when you start hearing about or hearing braking action reports that are less than favorable, what do you do?

MR. RODRIGUEZ: What we'll do is we'll respond to the runway, to the area in question, and what we'll do is it will usually be a simultaneous response. We'll have an individual that's assigned to the airfield in addition to an air side manager. We have an operations supervisor who is also assigned to the airfield to monitor conditions which is separate from the friction testing individual and usually you'll have all three resources possibly heading out to that location to make an assessment, to try to preclude a closure of a runway, and to see whether the pilot reports, you know, confirm what is actually out there or is it, you know, not in, you know, not in concurrence with what we're seeing, and that's kind of what we do, our initial response is, and we might suspend an aircraft operation, let's say for example, we've got a poor report or nil or some type of a bad report. We'll respond, assess the situation. If need be, we would ask the control tower to send the aircraft around if it's a close proximity between arrivals, and then make that assessment. If we need to close the runway, we'll close the runway or we might conduct a snow removal team pass to improve the conditions if, in fact, they are in conjunction with what the pilots are reporting.

MR. GEORGE: Let's say that on the night of the accident that the accident had not occurred. What would you estimate the time period that the snow removal team would have been back on 31C?

MR. RODRIGUEZ: I believe they had -- they were trying to get back or they were getting stuff to get back on the runway prior to that aircraft arriving. I think we were averaging -- I want to say in about a five hour span prior to the accident, we had about 15 friction surveys conducted. So we were probably averaging about three an hour. So usually what happens is when our snow removal team moves onto a runway, our friction device is either moving with them or immediately after the exiting of our snow removal team, our friction device will enter the runway and conduct his pass. So it all happens fairly quickly, but we were probably in the process around that time to try to get back on the runway because we were at the 31C pad location completing our, our clean off of the equipment. So --

MR. GEORGE: How long does it take to -- once you get finished at one end, all the way down the runway, to get that entire broom team and plows and everybody back around to the approaching?

MR. RODRIGUEZ: The pass from one end of the runway to the other, and this varies slightly depending on the intensity of the snow, the type of snowfall and whatnot, and also wind direction, typically I'd say about anywhere from 10 to 12 minutes is an average timeframe to get from one end to the other, and then the other consideration is that you have to take into consideration the cross runways and taxi runways because you can't plow snow onto those areas if they're being utilized. So you have to swing out and grab that as well. So I'd say an average of about 10 to 12 minutes to get to one end, and then they need to cycle back and usually that happens via the primary taxi route back to the terminal and then or back to the runway. So I would say 10 to 12 one way and then maybe another, you know, 10 to 12 or 10 to 15 the other way. So --

MR. GEORGE: Are you ever hampered in taking friction surveys due to air traffic?

MR. RODRIGUEZ: No, we have a pretty good relationship with our air traffic control tower and like I said, the coordination is key between airport operations individual working side by side with that controller, and I think that having that there is what facilitates quick and continuous or repetitive friction testing on the runways.

MR. GEORGE: There at Midway you have both continuous friction measuring equipment and decelerometer devices available and they were available that night. Given the conditions on the night of the accident, would there be any advantage in using one type over another?

MR. RODRIGUEZ: I'd say that they're pretty interchangeable for us. We don't have any problems using one device or another, and that night we were running both of them so that we can monitor, you know, the field more completely. So, yeah, I'm sorry, the answer would be no, there's no, there's no correlation or difference between the two for us.

MR. GEORGE: Well, you've been around both types in the job for a while. What's your gut feeling on the accuracy of the different types? Do you have any opinions there?

MR. RODRIGUEZ: I mean we don't have any problems using the devices. It's a very useful tool that provides us great, you know, factual data. That's kind of what we're looking for is some kind of a realistic assessment of what's going on outside of whatever everybody else thinks is going on out there. So that's a very useful tool in that respect and, you know, we're very happy with the results and then tend to correlate with, you know, in our experience in past snow events, tend to correlate with what we're doing out there.

MR. GEORGE: When was the last time the Beaumont that was used that night, when was the last time that machine was calibrated?

MR. RODRIGUEZ: That machine was calibrated in 2005, I want to say May of 2005, somewhere at the beginning of that month. I'm not exactly sure of the date.

MR. GEORGE: Is that in accordance with the manufacturer's recommendations on --

MR. RODRIGUEZ: Correct. We send those out for calibration every year, prior to the snow season, of course.

MR. GEORGE: Could you describe the level of experience of the gentleman that was operating the Beaumont that night? How many months or years of experience does he have working that sort of equipment and taking that kind of reading?

MR. RODRIGUEZ: The individual that operated that piece of equipment that night, and coincidentally he was the same person that took both readings and all the Beaumont readings throughout that even, he, he's been with the Department of Aviation for over 10 years, and he's operated it pretty much every piece of friction device that we've had over the years which is more so than the two different types that we have right now but he's had quite some experience with that, and in addition to the snow removal operations, we also use the friction devices year round. So that's something that, you know, is beneficial in respect to CFMEs, our staff uses them during the non-winter season, as frequently as once per week per runway. So he's pretty proficient with all of that equipment.

MR. GEORGE: Do you provide or does Midway Airport provide any kind of training per se on -- let's just stick with the friction testing equipment. Do you supply any particular training for the different types for the drivers?

MR. RODRIGUEZ: Initially when we acquire a device like the friction or decelerometer or electronic decelerometer, we get the initial training done by the manufacturer. They provide us with manuals and quick reference cards, and then every year we do a review of the operation of our equipment that we utilize for our operations staff. In addition to that, we also review the advisory circulars to keep up with any changes or recommendations that might have come up. So that's primarily an annual review process for us in addition to like I said, you know, the friction test is specific. It's something that, you know, we utilize year round. So it's hard to forget how to use it.

MR. GEORGE: Well, for somebody like me that really doesn't have any experience at it, could you take us through or describe what a person would be doing if they were -- if they had the Beaumont out there, and they were going to do a friction survey?

MR. RODRIGUEZ: Sure. When, when they initially acquire the device, they go out into the vehicle, properly set that up inside the vehicle. The way we utilize it, we set it up in the front passenger seat. It gets strapped in with the seatbelt. At that time, we go out onto the surfaces. They do a series of calibration tests on that device to make sure that everything is zeroed out and ready for test. Once you get the okay from the system, then they go ahead and proceed their test. We do a minimum of three tests per each third of the runway. On occasion, some of our staff will even go as far as doing 15 and as long as we do them in variables of three, the computer system is able to calculate and figure out the averages. So that's basically how you go and we do that along the whole process of the runway, and again, the electronic decelerometer provides us or enables us to provide the aircraft operator with a more conservative report of what's out there because we're going to be looking for the problematic areas or anything that's of a concern that's on a runway, and that's where we're going to try to get a read in the process of all the nine reads for the three thirds of the runway.

MR. GEORGE: Even more fundamentally, do take off and go up to 40 and slam on the brakes and then take off and go up to 30, 40, whatever your --

MR. RODRIGUEZ: Yeah, that's, that's part of the process and that's part of the training that was done with the manufacturer and they actually went out with each individual airport staff member and went out and explained to them the proper application of, of the braking methods.

MR. GEORGE: Well, with your knowledge and your experience in airport operations over the years, this is a philosophical question, can you think of any changes in FAA requirements, in snow removal procedures, in friction testing procedures, dissemination of information, or anything else that would improve safety during winter operations from the airport perspective?

MR. RODRIGUEZ: I think any supplement to what we're doing is always helpful in respect to communicating the friction information for example and this is -- I'm just conceptually speaking, but any supplement to how we're doing things is a very necessary method because some of that enables us to rely on scientific data if you will. So a supplement to that would be to possibly figure out a way to get the information to the aircraft more directly or more promptly. I mean we're doing it pretty quickly with the electronic log system but I think there were ever developed a direct link to the aircraft from the airport operator in some respect, maybe that would be helpful and then, you know, conversely from that end back to ours, you know, if there is any type of correlated friction information that the airport can obtain from the aircraft, that will also help us to paint a better picture of what we're looking at on the runway and assist the conditions, but again, any supplement to what we're doing would always be considered helpful.

MR. GEORGE: Is there anything that you think the airport should have done differently on the night of the accident with relation to snow removal procedures or friction testing or runway condition reporting?

MR. RODRIGUEZ: I don't -- that's a good question. I don't believe that there was much of anything else we could have done. The snow that night was very manageable be it a great amount occurred over a short period of time but the fact that we had all the resources on hand enabled us, like I said, to maintain that runway condition to pretty close to wet condition and outside of throwing more of the same at it, I mean I don't know how much of a benefit that, you know, we only have 150 foot wide runway. So I can't foresee doing anything else that could have improved that operation I don’t think.

MR. GEORGE: Thank you. I don't have anymore questions.

CHAIRMAN ROSENKER: Thank you, Mr. George. We'll begin with the parties. Southwest Pilots Association?

CAPT. HEFNER: We have no questions.

CHAIRMAN ROSENKER: Thank you. Southwest Airlines?

MR. LOGAN: No questions, Mr. Chairman.

CHAIRMAN ROSENKER: Boeing Aircraft?

MR. SMITH: No questions from Boeing, Mr. Chairman.

CHAIRMAN ROSENKER: FAA?

MR. WALLACE: Just one. Mr. Rodriguez, would you -- you talked about the factors in deciding when to do snow removal. Would you do snow removal on occasion just based on a runway friction measurement?

MR. RODRIGUEZ: How do you mean, sir?

MR. WALLACE: Well, for example, after the accident, the prior witnesses showed that the friction measurements were in the order of .4 or something like that. Would that -- to what extent would that dictate that you do snow removal or would it be just a factor you consider?

MR. RODRIGUEZ: Well, I think the way that we approach snow removal operations at Midway Airport, is regardless of whether our friction numbers are .4 or .67 or .80, for us if there's a precipitation occurring, we are in the snow removal process. Whether the -- are all good all day long and friction numbers are through the roof, if it's snowing, we're still running snow equipment out there, and I don't know if that completely answers your question but, you know, at a minimum we would obviously conduct them according to the standards that FAA sets forth, but we are never near that point, and again anytime any precipitation is occurring, we are mitigating that regardless of whether the readings are great or average or fair.

MR. WALLACE: Thank you. Nothing further.

CHAIRMAN ROSENKER: Thank you. Finally the City of Chicago?

COMMISSIONER FERNANDEZ: The City of Chicago has no questions for the witness.

CHAIRMAN ROSENKER: Thank you, Commissioner. We'll begin with the Board of Inquiry. Dr. Ellingstad.

DR. ELLINGSTAD: Thank you. Now you mentioned this particular operator that was working the friction test the evening of the accident had about 10 years of experience?

MR. RODRIGUEZ: Yes, sir.

DR. ELLINGSTAD: How many operators do this testing for you?

MR. RODRIGUEZ: We have approximately 12 operators that conduct friction surveys.

DR. ELLINGSTAD: So this is pretty much an interchangeable thing in terms of who might do it at a particular time?

MR. RODRIGUEZ: Absolutely.

DR. ELLINGSTAD: And you mentioned that there is training that your organization receives when you procure new equipment. I didn't catch whether or not there is a recurrent kind of a training for the operators on any regular basis. Is there?

MR. RODRIGUEZ: Right, there is, and that is conducted by our own staff.

DR. ELLINGSTAD: Do you accomplish any kind of performance evaluation for the operators? Are they checked out and is their skill in doing this systematically evaluated?

MR. RODRIGUEZ: What we do is we actually go out with each individual and have them run through some testing.

DR. ELLINGSTAD: So it's an OJT sort of a process?

MR. RODRIGUEZ: Exactly. Our senior airport operations staff oversees that part of the training.

DR. ELLINGSTAD: Okay. And finally, I know you had a slide with respect to your system, your electronic logging, but would you just refresh me again in terms of in accomplishing a particular test after the runway is cleared, and you've done these tests for each third of the runway, specifically how does, how does the data get to where the carriers or the pilots can use it?

MR. RODRIGUEZ: Sure. The information is transmitted initially via radio transmission. An airport operators staff member in the office that's dedicated to obtaining this information, he takes that information immediately and enters it into the log system, which is an interface by which the information is posted to the website. So it's a form that we use that is not -- it's fairly similar to what the end user is seeing on their screen but what that individual does, he enters the information and then once that is entered, it automatically posts to the airport website and automatically and simultaneously posts to the FAA IDS 4 system, and at that time, it can be viewed by anybody at anytime. I mean an operator or an airline operator can essentially log onto an alarm system and leave it on a display screen all day long and it'll update automatically. It has similar to the ATIS system, it has an authentication letter and timeframe so you know what you're looking at and when it was last reported, in addition to the times being referenced on the friction surveys and field condition reports.

DR. ELLINGSTAD: But mechanically the operator of the friction tester is radioing in these measurements and then it is being --

MR. RODRIGUEZ: Entered.

DR. ELLINGSTAD: -- transcribed.

MR. RODRIGUEZ: Correct, and then the person at the control tower is also relaying this information because he's monitoring the radio transmission as well, and the operator has obtained this information from the actual -- printout.

DR. ELLINGSTAD: Okay. Thank you.

CHAIRMAN ROSENKER: Thank you, Dr. Ellingstad. Mr. Clark.

MR. CLARK: No questions.

CHAIRMAN ROSENKER: Mr. Benzon.

MR. BENZON: Just one, sir. The first post-accident friction test, was that part of a checklist item that you gentlemen automatically do or is it a good thought on somebody's part or what?

MR. RODRIGUEZ: That is actually criteria that's spelled out by the FAA. That's one of many factors that dictate when you need to conduct a friction survey.

MR. BENZON: So the FAA says do one after every off runway incident or whatever?

MR. RODRIGUEZ: After every incident, yes, correct, sir.

MR. BENZON: Okay. Thank you. That's it.

CHAIRMAN ROSENKER: Thank you, Mr. Rodriguez.

MR. RODRIGUEZ: Thank you, Mr. Chairman.

CHAIRMAN ROSENKER: I appreciate your testimony. Your contributions today, your presentation and your candid answers. You're excused as a witness

(Witness excused.)

CHAIRMAN ROSENKER: And we will take a -- I'll be generous, a 45 minute break. We'll be back at 1:30 promptly to begin our next panel. We're in recess.

(Whereupon, at 12:45 p.m., a luncheon recess was taken.)

A F T E R N O O N   S E S S I O N

(1:30 p.m.)

CHAIRMAN ROSENKER: We're reconvened, and we'll call the Southwest Airlines witness, Mr. Denny Mosseller. Mr. Benzon, will you swear in the witness please?

MR. BENZON: Okay. I'll do it from up here this time.

CHAIRMAN ROSENKER: Okay.

MR. BENZON: Sir, remain standing please. Raise your right hand.

(Whereupon,

DENNY MOSSELLER

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

MR. BENZON: Sir, before we begin, we'll need to qualify you a little bit. Could you spell your last name for us and then tell us what you do at Southwest?

CAPT. MOSSELLER: Yes. The last name is spelled M O S S E L L E R, and I'm the Senior Director of Training and Standards for the Flight Operations Department of Southwest. My responsibilities include the oversight of the Flight Training Center, all of our training programs, our standardization programs and our manuals.

CHAIRMAN ROSENKER: Thank you for joining us here, Mr. Mosseller. I appreciate your contributions and your testimony that you're about to give. Do you have a presentation first?

CAPT. MOSSELLER: I do not, sir.

CHAIRMAN ROSENKER: You do not.

CAPT. MOSSELLER: I do not.

CHAIRMAN ROSENKER: Okay. We'll begin with the question areas, with Captain Kirchgessner first.

CAPT. KIRCHGESSNER: Captain Mosseller, welcome.

CAPT. MOSSELLER: Thank you.

CAPT. KIRCHGESSNER: I appreciate you attending to give us your input here for the hearing. I have a few questions for you, and if you're ready to get started, we'll go ahead and get started.

CAPT. MOSSELLER: Absolutely.

CAPT. KIRCHGESSNER: Okay. I'm interested in how your pilots determine the adequacy of the landing runway when adverse conditions are present, and I'd like you to start with a description of the information the pilot receives from the dispatcher for the destination runway.

CAPT. MOSSELLER: Typically the captain will receive a weather packet and a dispatch release prior to departure, and once that's given to him from the operations agent, at the departure station, he will review that dispatch release and the weather packet and if there are questions as to the nature of the conditions that are in place at his arrival at the airport, then at that point there will be a phone call typically to the dispatcher to discuss what those conditions were, how lately had they been updated what the fuel load looked like, alternate situation, what the likelihood of actually getting in, what the weather had been doing for the past few hours, and questions of that sort. So it would actually begin with that process followed by a review by both the captain and the first officer, where that information is hopefully shared with both sets of eyes taking a look at it and making a preliminary decision as to whether or not the plan that the dispatcher has laid out for them is something that they feel is feasible and prudent.

CAPT. KIRCHGESSNER: Okay. Once he has all that information, how does he use that information en route in his decision making as to whether or not to land at the destination?

CAPT. MOSSELLER: Once the flight has actually departed, then typically during the climb out and first portion of the en route, that period of time is more devoted to getting on the proper route and establishing the cruise altitude but as they get closer to the station, at about the 150 mile point, then typically the activity will pick up again where the pilot not flying or the pilot monitoring, will gather the ATIS information, contact the station, calculate the landing data, the projected landing data in an on-board performance computer, and then basically once they've gotten that information, the pilot flying is required to give an arrival brief, and what we're basically doing at that point in time, is building a plan for not only the arrival, but the approach, the landing runway, even to include the taxiway that we might be using to exit the runway. That would certainly include at that time any adverse conditions that are present at the airport.

It would also include considerations as to whether or not we would be -- what type of an approach we would be flying, and what we would expect.

From that point, once the initial plan is made, then the pilots would typically continue to gather information from different sources as they began the descent into the arrival city. Typically that would be either via an ACARS data link with our dispatch, a radio contact with the station, even listening to the tower frequency on a secondary radio, as they got closer within radio range, VHF radio range, to hear exactly what is going on at that moment in time at their arrival airport. That continues on all the way through the descent phase and as they get over onto approach, typically approach is going to have very up to date and reasonably accurate reports about what is going on. Again, they'll be listening. If it's really adverse conditions, they'll be listening to the tower. They'll be considering rerunning the data in the on-board performance computer if the conditions have changed significantly, and from that point they continue to refine that plan to gather that information and to make a determine, in sorts a mini risk assessment as to whether or not the approach they're going to fly, the arrival runway and their plan is prudent, and that would continue right up through the approach and the arrival.

CAPT. KIRCHGESSNER: I believe Southwest has what's known as a field condition report. Can you explain what that field condition report is and how it's utilized?

CAPT. MOSSELLER: Well, typically as an airport begins operations for the day, very early in the morning, the operator will give a -- will take an assessment of what the facility, what is going on at the facility at that particular morning. That assessment might include runways that are partially closed, completely closed, nav aids, taxiways out of service, anything that might be unique or unusual to the operation that can then be shared with the tower which is subsequently shared with our flight dispatch department and then ensuing that to the pilots via the weather packet and the dispatch release information that they get, although I might add that the field condition reports, as you could expect, things can change quickly especially in a very dynamic situation, that the pilots are encouraged via a note on the weather packet, for current field condition reports, contact the dispatcher.

CAPT. KIRCHGESSNER: Well, is there a process for updating the field condition reports?

CAPT. MOSSELLER: I'm not familiar with the requirement that the advisory circular sets out for the operators as to how often they have to update the field condition reports. I do know that they do it first thing of the day, and you'll see them in the weather packet but the typical scenario would be that the captain, if concerned about that field condition, would just pick up the phone and call our dispatch office.

CAPT. KIRCHGESSNER: Would it be typical for the dispatcher to automatically relay the field condition report to an en route pilot?

CAPT. MOSSELLER: If there are conditions at the airport, obviously the dispatcher's role is one of oversight of that flight and not only the planning, but also the oversight and flight following of that flight, and he would certainly, if conditions were changing, send an ACARS message or do a radio hookup with that flight to let them know what the circumstances are for that arrival, as it obviously has huge implications on alternates that they've already planned and/or fuel loads and such as that.

CAPT. KIRCHGESSNER: Okay. All right, Captain. Let's move into another area. At Southwest, how much emphasis is placed on mu values and what type of training does the pilot receive regarding interpreting those values?

CAPT. MOSSELLER: The mu values, we have to my knowledge since I've been a captain which has been since 1984, to my knowledge the mu values, we've always had a chart in our operations manual, and it's obviously discussed during the captain upgrade process as to -- and initial training, as to what value do we give it, what purpose does it serve, how do you weight it, and essentially and I'm more familiar with the captain upgrade discussion on that, that comes from both the classroom discussion that they have and also during our operating experience, is that they are basically given and taught, that is one piece of information, that it's obviously more of a quantitative measurement than a pilot braking report, but that it is just one piece of the puzzle in building that picture that might also include the approach you're flying, the visibility, is it night or is it day, how long is the runway, projected stopping margins, the actual weather conditions existing at the time of the approach, that it's added in as one of those pieces of the puzzle, that the pilots are trying to build a picture. So they then, in doing their risk assessment, decide whether to shoot that approach and to land on that runway is prudent or not.

So directly in response to your question, I think that the training that is given on mu is the fact that it is in our books, that it is a piece of information that can be used by them, but nothing specific as to the -- obviously we tell them that there are different types of vehicles and devices that are used, but we don't really get into any very detailed specifics about those individual devices and their relationship.

CAPT. KIRCHGESSNER: And based on your experience, Captain, would you say it's common or uncommon for a pilot to receive a mu value report?

CAPT. MOSSELLER: Based on my personal experience, and I've been flying at Southwest now for 35 -- 29 years, for 29 years at Southwest and a Captain since '84, it's been my experience that you don't get a lot of mu readings unless -- my personal experience has been that if it's an extremely bad runway surface, adverse conditions, that you could see them in the ATIS, and I have seen them in the ATIS several times over the years, and that the tower controllers will give you the new reading once it's below I believe about a .40, and I have had the tower controllers give it to me but on a scale of how many times have I gotten it, I would say it's relatively infrequent.

CAPT. KIRCHGESSNER: Okay. Now we've gotten a pretty good description of what braking action reports are earlier today. So I'm not going to ask you to go through that, but I would like you to describe how the Southwest pilots are trained to give a braking action report.

CAPT. MOSSELLER: Typically as I believe the gentleman from United, Mr. DeGroh, discussed, when our pilots show up as I'm sure United's as well, the competitive environment that we're in right now, our new hire pilots have 5,000 hours average flight time when they show up on the property of which about 2400 of that is pilot-in-command time in turbine, turboprop or turbojet type of aircraft. That time may have taken them from as little as 5 years, 6 years, to 10 years plus to gather that, in any number of environments including military aircraft and/or civilian operations flying in all kinds of weather. So we hire very good people. When they do show up, during their initial training, we have a two day course, it's not quite a total of two days but during that module, we talk about takeoff and landing safety and during the landing safety portion of it, they receive instruction on adverse conditions, how they're entered into the on-board performance computer, and how we actually deal with that. Once they go out onto the line with their check airman for 25 hours of operating experience, essentially there is a discussion item that the check airman cover with them as far as approaches and landings include adverse conditions. The pilot will typically spend 6 years in the right seat at Southwest currently, and during that time, they'll accrue another 5,000 hours of operating experience, real line operations in our system, flying our aircraft throughout our 61 or 62 cities, in all kinds of weather, so that by the time they upgrade to captain, they've basically got around 10,000 hours average, and 6 year minimum in the 737 in our system. So the way it was described this morning, I would have to agree with completely, is that it is an experience gained that gives you the ability to determine what braking action you're feeling at that time, that by putting a definition on paper, albeit a noble cause, it's very difficult to take a definition from a piece of paper and to translate that into what it actually feels like to land on a runway with poor or fair or nil braking for that matter. So they go through the captain upgrade process, again a discussion item in ground school from our references in the FOM. We have a several page section on landing with braking advisories, less than good. We go into great depth with them in the communications aspect of the captain's job, and that we don't teach them how to give a PIREP or a braking action report because the AIM basically covers that and that's in very early on in the piloting phases. We don't cover that exactly but what we do talk about is the importance of gathering information from all available sources and not short siding yourself and cutting people off, whether it be your dispatcher or the station or the first officer or whomever, to make sure you get all the pieces of information and then to make an informed decision. So that once they're out there as a captain then, they're basically we feel very tuned -- in tune with the criticality and the flight operations directs them, that it is essential that they give accurate and timely weather reports, whether they be hazardous weather or just PIREPs of a normal nature, but certainly on a braking action as critical as that can be, that they give that in a timely manner to the tower and to the station, and as they follow up, once they get to the gate, to pick up the phone and call dispatch and make sure that the dispatcher working that city is aware of what's going on and not depend or assume that a report getting passed to them.

CAPT. KIRCHGESSNER: So based on the subjectivity of it, you feel that the training at Southwest is adequate in that area?

CAPT. MOSSELLER: It is certainly a very subjective area. I mean it is one of those things that again I would say I do believe that what we're giving our new hires and our captains are good tools to go out there and make those subjective decisions. The fact is that it's almost impossible to avoid experiencing those conditions over six years and, you know, you go back to how many actual takeoffs and landings we do a day, we fly over 3,000 flights a day, almost a million a year. You know, our guys are generally getting 30 to 40 takeoffs and landings each a month, not as a crew, but each, that it's almost impossible not to see those conditions. And so then we feel like just by virtue of the subjective nature of that whole area, that we want to -- we've discussed giving it to them in the simulator, we've done a lot of -- given it a lot of thought quite frankly, and we come back to the same conclusion, that the training on that area has -- the vast majority of the real training has to be through line experience and hence the supervision of a captain or a check airman and experience gained before they get into that position.

CAPT. KIRCHGESSNER: Okay. Very good. If you would, would you please compare and assess the value of a braking action report given by a Southwest pilot versus that of a Part 135 or a Part 91 aircraft pilot.

CAPT. MOSSELLER: I guess I would have to characterize it as if I, me personally, I were out there, my order of choice would be that I would hear the braking action from another Southwest 737 aircraft. My second choice would be another 737 aircraft from another carrier. Third choice would be another air carrier jet aircraft. Probably fourth choice would be either a Part 135 or Part 91 jet aircraft. And last choice would be some sort of a turboprop type of aircraft due to the differences in the stopping devices that they have on those airplanes as compared to ours. But I would certainly prefer to hear it from one of our pilots based on what I previously said, the fact that we do have a very standardized operation and it's -- you can, you can count that if somebody lands and they followed our procedures which we have to assume that they did and got the aircraft safely stopped, that that's going to be a reasonably accurate assessment of what you can expect as long as it's not a long time delay between the arrival of that aircraft and your aircraft. I would not discount a Part 135 or Part 91 if a very severe braking condition report was given but what it would cause me to do is to either hold and/or just not shoot the approach until I gathered some additional corroborating information, whether it be a friction report from the airport or another aircraft landing or something of that nature, that I would be hesitant to accept the risk with very minimal stopping margins just based on a Part 91 or 135 operator, if that's all I had to go with.

CAPT. KIRCHGESSNER: Okay. We've also gotten a few definitions earlier in the hearing on the mixed braking reports. So I won't ask you to redefine that, but can you tell me how a mixed braking report prior to the accident was addressed in the flight operations manual?

CAPT. MOSSELLER: Yes, sir. As a matter of fact, the verbiage that was contained in the flight operations manual at the time of the accident which we thought certainly addressed that issue, basically said braking action reports less than good are classified according to the most critical term (fair, poor or nil). In conjunction with that, I think that's -- again, if you take that out of context, the piece that goes along with that is the fact that we do try, in that in our initial new hire training during the takeoff and landing safety module, and they're clearly shown there and get to work problems with an adverse condition, where they're given a good to fair or fair to a poor and they see that you have to enter the most critical condition into the performance computer to get an appropriate answer out of it. That's again covered in our 2005 recurrent training class, and it's been modified slightly, but it's covered again this year in 2006 recurrent training class where they're given a snow scenario in Baltimore I believe that basically requires them to see that it's a variable mix braking action report and that they're to enter the most critical term.

CAPT. KIRCHGESSNER: Can you read the definition one more time that you had prior to the accident?

CAPT. MOSSELLER: Yes, sir. Braking action reports less than good are classified according to the most critical term (fair, poor or nil).

CAPT. KIRCHGESSNER: Now does that definition refer to the pilot or does it refer to an actual ATC report?

CAPT. MOSSELLER: It -- in our estimation, it's the directive to the pilot to say that the most critical term is what you use. Now the most -- obviously the tower would, if they're giving a mixed braking action report, and say fair to poor, how they choose to interpret that I'm not sure but that's the way that our guys are taught to interpret it.

CAPT. KIRCHGESSNER: Okay. And then you mentioned that this has been modified a little bit since the accident.

Has that verbiage been changed any?

CAPT. MOSSELLER: It has been modified slightly since the accident, the initial sentence that I just read to you is still present and immediately following that is an additional sentence that says if a combination is given, example, fair to poor, use the more restrictive of the two. And that was added as an attempt to hopefully beyond any doubt decrease any doubt in anybody's mind that if you're given a condition, whether it's concerning braking action or tailwind, you use the more restrictive condition and put in the worst condition.

CAPT. KIRCHGESSNER: And has the new verbiage been put out to the pilots?

CAPT. MOSSELLER: Yes, sir, it has.

CAPT. KIRCHGESSNER: Okay. One final questions, Captain, that I wanted you to clarify for us. A little bit earlier, Captain DeGroh mentioned that most pilots did not know that a reverse thrust credit was factored into many of the landing calculations. Prior to the accident, was that statement true at Southwest?

CAPT. MOSSELLER: Prior to the accident, out pilots were taught, in again that initial takeoff and landing safety when they are first hired with Southwest, in on-board performance computers, there were problems from both types of aircraft, the classics and next gens, that the classics, it was not considered in the credit, the stopping margin credit. It was not given credit for, and conversely that it was given credit in the 700. Our manual at the time, there was one inconsistency in there that has since been corrected, that we realized that it was -- probably could lead someone to believe that, in fact, in the next generation aircraft that perhaps the thrust reverser was not considered but that has been corrected, and it matches up throughout the book.

CAPT. KIRCHGESSNER: Okay. Thank you, Captain Mosseller.

CAPT. MOSSELLER: Thank you, sir.

CAPT. KIRCHGESSNER: I have no further questions, Mr. Chairman.

CHAIRMAN ROSENKER: Thank you very much, Captain. Dr. Lemos, did you have questions?

DR. LEMOS: No questions. Thank you.

CHAIRMAN ROSENKER: Thank you very much. We'll now go to our parties. City of Chicago.

COMMISSIONER FERNANDEZ: The City of Chicago has no questions for this witness.

CHAIRMAN ROSENKER: Thank you, Commissioner. Southwest Pilots Association.

CAPT. HEFNER: The Southwest Pilots Association has no questions.

CHAIRMAN ROSENKER: Thank you. Boeing, do you have questions?

MR. SMITH: Boeing has no questions.

CHAIRMAN ROSENKER: Thank you. The FAA.

MR. WALLACE: I just have one or two, Mr. Chairman.

Captain Mosseller, you talked briefly about what goes in the OPC and -- the issue of the lower braking action report has been clearly covered. Thank you. One question about accepting braking action reports, my sense then is you don't have any prohibition against accepting braking action reports from non-Part 121 operators so that it's the pilot's discretion judgment I assume?

CAPT. MOSSELLER: Yes, sir. Certainly there's no prohibition. The example I would give you was that at some of the smaller airports, certainly not at Chicago Midway, but at some of the smaller airports, the first one or two aircraft arriving may very well be general aviation aircraft and it might be a Falcon 20 or a DeHavilland Twin Otter or any version of aircraft and hence my discussion about what you would prefer to have but, no, we would not discount that completely. It would just give me personally cause to gather more information before I made that decision as to whether or not I was going to land or not.

MR. WALLACE: And in your training, I understand that there is a prohibition, a tailwind maximum, am I correct, of 5 knots maximum tailwind component permitted when braking conditions are reported as poor?

CAPT. MOSSELLER: Yes, sir. That's presently in our operating manual.

MR. WALLACE: Okay. And was it in your operating manual at the time of the accident?

CAPT. MOSSELLER: Yes, it was.

MR. WALLACE: Okay. Thank you. No further questions.

CHAIRMAN ROSENKER: Finally the Southwest Company.

MR. LOGAN: Southwest Airlines has no questions. Thank you.

CHAIRMAN ROSENKER: Thank you very much. Dr. Ellingstad of the Board of Inquiry.

DR. ELLINGSTAD: Just one question. In using information about runway friction measurements, is there a way to factor into your decision making differential friction on different segments of the runway?

CAPT. MOSSELLER: I think the only role that that would play in my opinion is that depending on the projected stopping margin of the aircraft that our performance computer is giving us, depending on the weather conditions obviously, the type of approach that we're flying, whether it be a non-precision or precision, do we have a reasonable expectation that we're going to be able to get it on the ground brick 1, certainly at the 1,000 foot and very close to that point, that if the condition is called poor in some segment of the runway, I have to decide if that's -- to what degree that's going to affect my arrival, and will I be stopped, if it's a 13,000 foot runway, and the last 1,000 feet is poor, will that really affect my arrival. So I would factor it in that way, just try to make an assessment of how much that portion of the runway and what its report was, would affect my own arrival.

DR. ELLINGSTAD: So this would be reflected in the pilots decision rather than in any kind of an algorithm.

CAPT. MOSSELLER: That's correct, sir.

DR. ELLINGSTAD: Thank you.

CHAIRMAN ROSENKER: Thank you, Dr. Ellingstad. Mr. Clark?

MR. CLARK: Just a couple. It wasn't clear to me the issue of the OPC and being unfactored data. Was that clear to all your pilots? When you saw a number in the OPC, that was the number. There were no safety margins. There were no additives in that data.

CAPT. MOSSELLER: And I think at the risk of going someplace that I'm a complete expert, I would defer to Brian Gleason, our performance engineer, but that the pilots, the number that they see in the on-board performance computer as to what level of safeguards if you will or margins that are bought in or built into that number, that stopping margin number, I would say other than the reverse thrust calculation, that it probably -- I would be speculating on how many of them could tell you exactly what that is based on, other than the fact that our procedures, if it happens to pertain to reverse thrust, that we do basically the same thing every time with our thrust reverse so that it's a very much ingrain habit to select the reverse thrust up to the same level basically every time.

MR. CLARK: I understand that. But on this particular day, if the crew had used a value of fair, that would have said they had a 500 foot margin the way your OPC is set up, and did they believe there was extra margin on that or is that typical for a crew to accept that in these harsh conditions they're going to land and all things average, expect to stop within 500 feet of the runway -- of the end of the runway?

CAPT. MOSSELLER: The information, and we do teach this, that it is certainly if all stopping margins are bracketed, we can't land. So in that regard, it's not advisory. We're prohibited from landing, but certainly when a crew sees a 500 foot margin and begins to weigh that into, you know, their condition, you know, how perfectly can they execute the approach, the touchdown, and the stopping of the aircraft, that that would certainly have to weigh into their calculation that -- I don't think any of our crew members would think that if it said 26 feet, that they could get out of the airplane at the end of the runway and walk off 26 feet, that it is an approximate, and it is information that they use again to make that decision as to whether or not they can execute it to that degree, that it will be a safe approach and landing.

MR. CLARK: In that sense, I can understand the 26 feet, but even 500 feet seems awfully close for all of the things that not necessarily go wrong, but all of the things that can not go perfectly.

CAPT. MOSSELLER: There are certainly a lot of variables, and obviously we discuss that very explicitly that if the aircraft is landed beyond 1500 feet, that no matter what system you have, thrust reverse, auto brakes, the best technique in the whole world, that that data could become invalid, and at that point, all bets are off, and we very clearly tell them that. The issue as to what margins are built in, I would rather Brian Gleason, he can go into better detail I think than I can with that.

MR. CLARK: Well, I understand from kind of the engineering side that, and we'll get into those discussions of what margins were, were not available, but I was asking more from the operational side, as a pilot, sitting there looking at all things unfactored which means there's no additives other than that touchdown point, I guess your airline was comfortable that 500 feet would be an acceptable distance remaining to shoot for.

CAPT. MOSSELLER: And I think that the answer would be that, yes, our policy was that you had to have some sort of positive stopping margin at that point. That's certainly not to say that once the operation specification C082 comes out, that there won't be some adjustments made to that.

MR. CLARK: Okay. And then one more area. My understanding is in short order before the accident occurred, one of your pilots did divert. Have you talked to him or found out what prompted him to not land at Midway?

CAPT. MOSSELLER: Other than just reading their irregularity report about how they made that decision, that crew -- my memory tells me that that crew basically looked at the margins and realized that with -- at the point of their arrival, at that moment when they were going to make the approach, that the winds were pretty variable and that they were getting some fair to poor braking action reports, and that they elected -- they made the decision at that point that they didn't feel they could execute that landing, that approach and landing to the degree that they needed to, to successfully do that, and they diverted. I can't remember where they diverted to, but it seems like it was Indianapolis.

MR. CLARK: Have you provided any further guidance to your crews on the issue of downwind landings and how much to accept or do they still go with the OPC or do you try to discourage that now?

CAPT. MOSSELLER: We actually -- our limitations have not changed since the accident, that the -- and, and partly because of the fact that we do have a systems analysis team that is working through I believe six or seven issues that were brought to us by the FAA, and also with the knowledge that at a point in the future which we have begun now, that we were going to do a complete review of our operating margins which would include all tailwind limitations and any limitation basically in our book and also policy as far as our operating margins, and that has begun, but to this date, the tailwind limitations have not changed.

MR. CLARK: Okay. Thank you.

CHAIRMAN ROSENKER: Thank you, Mr. Clark. Mr. Benzon.

MR. BENZON: Just one quick one, sir. Are you aware of any hazards to the use of reverse thrust with a contaminated runway, slush ingestion perhaps or something like that, on a 737?

CAPT. MOSSELLER: With a -- specifically with a -- we have a prohibition. If there's clutter on the runway, we cannot dispatch within an operative thrust reverser but for the actual damage that could potentially be done with a slush, loose, wet snow condition, that potentially, it is my understanding, that if you sustain a reverse thrust at a very low speed, there is potential for that, that it can be ingested certainly in the engine and on the cell.

MR. BENZON: Okay. Thank you very much.

CHAIRMAN ROSENKER: Thank you. Captain, I would like to ask a couple of questions as well. You say you're in the midst of review?

CAPT. MOSSELLER: Yes, sir.

CHAIRMAN ROSENKER: So you have not made any changes yet?

CAPT. MOSSELLER: We have not.

CHAIRMAN ROSENKER: And do you propose to have these changes perhaps before we get into the winter flying season?

CAPT. MOSSELLER: Let me back up by saying that the systems analysis team, that's in place right now, we've been working through that for several months, and that we have implemented several of their recommended changes already, and there are more to be implemented. As far as our overall operational margins review, that has just begun but the intention is certainly to get it done and we're applying the resources needed to get it done.

CHAIRMAN ROSENKER: Before the winter flying season?

CAPT. MOSSELLER: Yes, sir.

CHAIRMAN ROSENKER: Thank you. And how about the revisions that you've done already. Perhaps you could share them with us, a couple of them.

CAPT. MOSSELLER: I'm drawing a blank.

CHAIRMAN ROSENKER: All right.

CAPT. MOSSELLER: I do have a document that shows, and I can provide you with that.

CHAIRMAN ROSENKER: That would be fine, Captain. I appreciate that. And just finally I asked Mr. DeGroh, and I will ask you the same thing, when you get into a situation where you begin to get reports that you're getting fair to poor, what procedural changes do you have or technique changes that you must utilize in order to accomplish a safe landing?

CAPT. MOSSELLER: Well, certainly our guidance to the pilots in any normal landing is 1,000, 1500 feet down the runway with the center line between the main gear, and that as the conditions deteriorate, and the stopping margins decrease, that certain as Boeing, from their flight crew training manual, and we've obviously emphasized that in our landing with braking advisories less than good, that the airplane is to be touchdown firmly, get the airplane in a three point stance with the nose wheel on the ground, and immediately deploy the thrust reversers to maximum if needed, and certainly make sure that the speed brake has been deployed by virtue of the fact that it is a slippery runway, and to continue with maximum manual braking with maximum thrust reverse until the aircraft, if need be, all the way to a stop. But -- I'm sorry.

CHAIRMAN ROSENKER: That's fine. Thank you. I appreciate that explanation, and finally I recognize it's extremely inconvenient and -- both for passengers, crew and the company to divert, what does it take to make a decision to divert?

CAPT. MOSSELLER: Well, typically unless you get a surprise where the weather has changed and it wasn't forecasted, or something either via an air traffic control situation has popped up or the radar goes down or a power failure at the airport, something that just completely catches you by surprise, which it does happen from time to time obviously, but the decision to divert is basically again at the top of the descent or part of the top of descent knowing that the weather is either very low visibility and/or ceilings and/or it could be an adverse condition that's at the airport right then, that you begin that planning process right then and have that conversation with the dispatcher and again, even though there was a divert field alternate listed on your release, is to not assume and go back and reconfirm that by checking the ATIS at the alternate airport, by talking to the dispatcher and coming up with a new plan based on how much fuel will we leave here with, and at that point in time then continuing to update that plan based on whatever estimated time your clearance may be given to you either out of the holding pattern or to just physically proceed to the airport but that decision is one that is a very high workload decision, typically one pilot flying the airplane and talking on the radio and the other pilot calculating through the flight management computer or the on-board performance computer and talking on the radio or sending ACARS messages back and forth to our dispatch, and as well talking to the station. It's a busy sequence.

CHAIRMAN ROSENKER: It's a big deal.

CAPT. MOSSELLER: It's a pretty big deal.

CHAIRMAN ROSENKER: It's a big deal. But somebody did do it prior to landing. Is that correct?

CAPT. MOSSELLER: Yes, sir.

CHAIRMAN ROSENKER: Another aircraft did?

CAPT. MOSSELLER: Yes, sir.

CHAIRMAN ROSENKER: Thank you. Captain Kirchgessner, did you have a clarifying question?

CAPT. KIRCHGESSNER: Yes, I do, Mr. Chairman.

CHAIRMAN ROSENKER: Certainly.

CAPT. KIRCHGESSNER: I just wanted to clarify something for the record. I believe I heard Mr. Wallace ask the Captain if the runway conditions are poor, is the tailwind limit 10, and the Captain agreed, and I believe it's 5.

CAPT. MOSSELLER: It is 5. I'm sorry. I thought he had said it was 5 before.

CAPT. KIRCHGESSNER: I may have been misheard.

CHAIRMAN ROSENKER: It will be changed in the record please, thank you.

Captain Mosseller, I appreciate your testimony. Thank you for joining us and participating with us again today, and we appreciate your candor and the information you shared with us today.

CAPT. MOSSELLER: Thank you, sir.

CHAIRMAN ROSENKER: Now you're excused as a witness.

(Witness excused.)

CHAIRMAN ROSENKER: We'll take a -- I don't think we need a break. This is a relatively short segment, and Mr. Benzon is as efficient as anyone I've ever seen in this business, and he'll be able to get that nameplate changed I'm confident for the next panel.

MR. BENZON: No problem. Would you please stand and raise your right hand.

(Whereupon,

JAMES MARINELLI and DAVE BENNETT

were called as a witnesses, and having been first duly sworn, was examined and testified as follows:)

MR. BENZON: And we heard from Mr. Marinelli, but Mr. Bennett, could you give us an idea of what you do for the FAA and how long you've been doing it?

MR. BENNETT: Yes. I've been with the FAA since '79, partly in the FAA Office of the Chief Counsel. For the last 11 years, I've been Director of the Office of Airport Safety and Standards, and that office is responsible for the engineering, airport's design, standards, Part 139 safety certification and grant compliance.

CHAIRMAN ROSENKER: Thank you. And this topic is Topic II. Is that correct, Mr. Benson? Runway safety area at Midway Airport and other airports with land use constraints.

We'll begin our questions with the Technical Panel. Mr. George. Did you have a presentation?

MR. BENNETT: We do if you want to do that.

Runway safety area, it's a cleared area around a runway, graded, free of unnecessary obstructions. It serves as a safety area for aircraft that go off the runway. We consider it an enhancement for safety, a very important and valuable enhancement, but it's not related to any operational requirement in any FAA rules. It's defined in Advisory Circular 150/5300-13, airport design, provides the dimensions and physical requirements and that was updated. Change 8 recently added an engineered material arresting system or EMAS as a means of achieving a standard runway safety area as an alternate to a defined area of ground.

The AC 5220-22A provides the specifications for an engineered material arresting system.

The current policies we have on runway safety areas are basically listed here. We'll go through each one individually starting with Part 14 C.F.R. Part 139, airport certification. The 1988 revision of the rule required to the extent practicable, each commercial airport would have to upgrade to the standard runway safety area at the next time there was major work on the runway and the standards, current standards for runway safety areas were in effect before that time. I think from the mid eighties.

In 2004, Part 139 was upgraded to change that language to, in a manner authorized by the Administrator but the meaning was the same.

The phrase to the extent practicable is not formally defined but the concept recognizes that it just may be technically possible to do a project but just not feasible or affordable or make sense for some reason. In practice, we've considered several factors to go into practicability. Clearly technical difficulty. It's just from an engineering standpoint very difficult but that can also include political and environmental considerations. Cost, cost benefit, and we bring that in with FAA Order 5200.9 which we'll talk about in a minute. Also the ownership or the control of the land needed for the RSA, and this is the Bridgeport situation, where the airport is perfectly willing to acquire and pay for the land for a runway safety area, but simply cannot get it from a neighboring jurisdiction that won't release the land.

And finally, we have considered the effect of kinds of solutions for runway safety areas on airport operations. If something shortens the runway to the point that it adversely affects the use of the airport and the utility of the airport, we would consider that not practicable.

MR. MARINELLI: We published Order 5200.8, runway safety area program in 1999, with the objective of bringing all runway safety areas at certificated and federally obligated airports up to standards to the extent that we could. We established the concept of the runway safety area determination in this order. This is a formal determination by our Regional Divisional Manager which would talk to the extent that we feel the runway safety area can be improved. It considers the entire runway safety area, even if the runway safety area is not standard. And, in the past, we considered the runway safety area up to the point where it existed and never really beyond that, and now we are trying to consider instrumental improvements to improve that 1,000 foot overrun as much as we can with the intent of sometime in the future, if possible, it would eventually be brought up to full standards.

This order also provides guidance to our field people in assessing the alternatives and requires that one of those alternatives that's being considered be EMAS.

Order 5200.9, and I won't read the title because it's just too long, was published in 2004. This provides guidance to our field personnel on financial aspect of the practicability of improving runway safety areas. It includes EMAS and basically provides our field people with a method of preparing the cost of a standard EMAS, and I can explain that a little later, with a standard runway safety area based on life cycle cost.

MR. BENNETT: For the organization of the FAA and who works on runway safety areas, Regional Airports Divisions in the Office of Airports, inventory the FAA's work with individual airport managers on upgrade projects, each Regional Division Manager in the nine regions is responsible for doing a practicability determination on any non-standard RSA at a Part 139 airport. Airport operators, to comply with Part 139 and also to be eligible for AIP grant funds for any work on the runway, would have to comply with the standards or the practicability determination issued by the Division Manager for that region. And in Headquarters, Rick's division, the Airport Engineering Division maintains the current inventory status, issues policy and shares responsibility with the other airports office, the Office of Planning and Programming for maintaining a funding plan for the upgrade of runway projects in the future.

MR. MARINELLI: There are several ways to improve a runway safety area. Some of these are actually buying land, through construction, through the establishment of EMAS, a concept of declared distances, that I will explain on the next slide, reconfiguring the runway, meaning shifting it in one direction or another or even possibly reorienting it, and elimination of non-frangible objects such as utility poles, ditches, even FAA navigation aids. And you'll notice that these numbers add up to more than 100 percent because it's quite common for an improvement to include more than one of these items.

MR. BENNETT: Now these are the percentages used in the upgrades we've done since 2000, the various kinds.

MR. MARINELLI: Declared distance is a concept that allows an airport to meet runway safety area standards when they don't have ability to expand. The declared distance application for a runway safety area would affect the landing distance available and accelerate stop distance available. It doesn't actually decrease the length of the runway but it does require the airport to publish a number that subtracts the runway safety area shortage from the actual length of the runway. This provides the cushion of typically a 1,000 feet beyond what the pilot would normally calculate as necessary for a landing and takeoff.

In the case of landing distance available, if the adjustment were made for runway safety area prior to touchdown for landing, it may require the threshold to be displaced, and that would actually decrease the physical length of the runway available.

MR. BENNETT: FAA does have a formal program to upgrade runway safety areas at airports where they're non-standard. Following the accident at Little Rock in 1999, Little Rock had applied for a grant to put in an EMAS and we had approved it, and that was being programmed at the time there was an accident. So the EMAS had not been installed at the time there was an accident.

At that time, we began looking hard at whether there were ways to accelerate the improvement of runway safety areas to standard or as close as we could get to standard that would be faster than what was required by Part 139.

The first thing to do with that was to do an inventory. We did that in 2000 of all Part 139 runways, found that about half were within standards, were within 90 percent, and for this purpose, we used within 90 percent because we didn't want to put a priority on ones that almost met the standards. We really wanted to put the focus where the ones that needed much more improvement, but those runways within 90 percent are still obligated to be upgraded in accordance with 139. They're not waived.

We found some could not be improved at that time. Those numbers would probably be smaller now, and at the time found 456 runway safety areas were not within 90 percent of the standards but could be improved and that became our target group. We began with a seven year plan to initiate upgrades, to begin the planning and planning for funding and getting under grant sooner than required by Part 139. So these would be standalone projects.

By 2005, we had initiated enough that we switched to the project which people were more interested in anyway or the goal which they're interested in, and that's the completion of projects, when they would be done. For this purpose, we did a comprehensive new inventory nationally, looked at every Part 139 airport, and had the airports and our regional people develop a funding plan for that, and the result of that is we will have completed all of the possible upgrade projects by 2015.

By 2010, we will have done the upgrades at 92 percent of the regional 456 that we started with. So it's kind of front loaded but there's a small number that will take that extra five years.

At the end of the program in 2015, 86 percent will be -- it says runways, it's runway safety areas, will substantially meet Part 139 standards and the remaining 14 will have been upgraded to the extent practical at that time. We would expect continuing upgrades after that.

Since 2000, under the program, we've done more than 200 of the projects we started and as of last year, August, when we did the inventory, 997 runways, we had about 66 percent which substantially, 90 percent or more, met standards of all runways. We had 248 left to be upgraded at that time, and we planned as our goal for our business plan, 34 to be scheduled for completion this year, and that's on track.

At Midway, we saw a chart earlier. There's four runways at the airport but only two are regulated under Part 139, commercial runways. So that's four ends that are subject to the requirement for runway safety areas. And they are all a problem obviously and I think they're constrained by the roads on each corner, the airport's within a square of major streets. There are blast fences, navigation aids in there, and the fact that the runways are oriented toward the corners, to get maximum runway length, means that the land off the end of the runway tapers and, of course, makes it even more difficult to fit a standard runway safety area in there.

Relations between the FAA and Chicago, we've been working with them for a number of years on this began probably formally in 2000, where we did our first practicability determinations in conjunction with the survey we did that year. The City found that none of the options available that year were practicable and advised us that we didn't disagree with that but the ADO, our Airports District Office, who is our main contact with the airports sent a transmittal letter back urging the City to continue to explore all options. So we have always considered it an option issue, and I think it has been that for the last five years, six years.

In continuing discussions, there's lots of discussions between the ADO and the City of Chicago and all sorts of things all the time but this did come up. In 2004, at our request, the City did a new practicability report of its own and its consultant did a very thorough analysis, and again found that none of the options for improving the RSA were practicable at that time.

We went back with the letter, it's dated 12/4 and actually never signed. It was handed as a draft in a meeting as a comment really in early 2005, and again not disagreeing with the conclusion, but requesting more information on the cost of some of the options that might have allowed some improvement, even if we couldn’t get the standard runway safety area.

The accident in December 2005, soon after that, the City and the FAA convened a meeting. Headquarters was there. We had the Regional Office there and the Headquarters office was represented, and the ADO met with City and consultants and there have been regular meetings between the ADO and the consultants since then, and we took another really hard look at what could be done with the runway safety areas at the airport. And what had changed really by then was the possible availability of some new technology in EMAS. This is a very constrained site that we would not have considered for EMAS several years ago. We are beginning to see some uses of it and we are doing some research at LaGuardia at this time on placing an EMAS unit much closer to the end of the runway than we had been able to do before, and that's based on some improvements in the EMAS system itself.

As a result of that, the City has developed plans for use of EMAS. They formally requested our approval of EMAS I believe at all four runway ends, and that was approved by the FAA by letter this month. FAA has issued a $15 million AIP grant. I don't know if it has actually been issued yet. It has been approved at least, for phase 1 of the work, and eventually all four runway ends will be funded with AIP assistance. The phase 1 will go toward the design, and I believe the first project will be the departure end of Runway 31C. And that's the end of our presentation.

CHAIRMAN ROSENKER: Does that complete your presentation, Mr. Bennett?

MR. BENNETT: Yes, it does.

CHAIRMAN ROSENKER: All right. We'll begin with our Technical Panel. Mr. George.

MR. GEORGE: Thank you very much. You pretty much answered almost all my questions but I have a couple left here that I can find. These may have the same numbers. My questions may ask for the same numbers that you put up there but in a different form, and tell me if that's true.

As of the 2000 RSA inventory, FAA stated 42 runways did not meet standards but 456 could be improved or brought up to standards. My question, my first question is what does brought up to standards mean?

MR. BENNETT: Brought up to standards means brought up to standards.

MR. GEORGE: Full length, full --

MR. BENNETT: Depending on how we use that, generally we mean as good as we can get. I mean --

MR. GEORGE: It doesn't mean full, dimensional --

MR. BENNETT: Not necessarily because we won't really know that until we do the design work. So it's usually a preliminary indication that it falls one way or the other. So I think -- when we say improve, we don't mean up to standards at that time. The 456 was either up to standards or improved somewhat.

MR. GEORGE: Okay. So improved and brought up to standards in FAA jargon is a different thing. What is improved versus brought up to standards?

MR. BENNETT: I think standards means standards. It would be a standard runway safety area and that could use EMAS at this time, a standard EMAS installation but with runway safety areas, there's a lot of benefit to some improvement. I mean it's not every 10 percent you get of 1,000 feet is not equal. The first 10 percent is worth much more than the last 10 percent. So anything you can add to what you have is the benefit, even if you can't get the full 1,000 foot.

MR. GEORGE: Granted. In this particular case, I'm trying to judge the success of the runway safety area program based on the stated goal which was to bring runway safety areas up to standards. To that end, I want some numbers to find out how many of the ones, the 456 that could have something done to, actually achieved full dimensional standards as opposed to, let's take that, out of 456, how many?

MR. BENNETT: Yeah, we have some summary numbers in here but I would rather get that back to you separately if I could. I mean it's on the order of 66 percent but --

MR. GEORGE: Okay.

MR. BENNETT: -- one thing, these numbers are moving targets because they're being worked on.

MR. GEORGE: I understand that. I've been asking for sometime for some of these numbers and I'm just -- I thought maybe I could get them today.

Refer to slide number 9. Can you get that back up? It's on your machine, but it's not up there. There it is. I had a couple of questions. You answered one. These are not mutually exclusive. They fall into several categories, many of those things there.

MR. BENNETT: Right, any particular project might use more than one means. So they'll add up to more than 100 percent.

MR. GEORGE: I'm going to sound like a parrot here in a minute. Land acquisition, that 3 percent that's there, can -- do those represent ones that were brought up to dimensional standards based on -- because of land acquisition?

MR. BENNETT: Yeah, these are not broken down by the ones that are full standards versus improved. So --

MR. GEORGE: So full dimensional -- ones that were brought up to full dimensional standards would fall under either of those two -- first two categories?

MR. BENNETT: Yes, they could be in any of them.

MR. GEORGE: Okay. Well, declared distances, you wouldn't need declared distances if you had a full -- necessarily, if you had a full dimensional RSA.

MR. BENNETT: You're right about declared distances, but the last two could bring them up to full standards.

MR. GEORGE: So construction grading is -- whenever I see something like construction grading, am I -- I’m not necessarily looking at construction of a full dimensional RSA. It may just be smoothing out a ditch or something in the 200 foot RSA and that would fall under that category?

MR. BENNETT: Right. That's correct.

MR. GEORGE: I think you've answered the declared distances. I had a question about how declared distances are applied and how they increase the margin of safety, and I think Mr. Marinelli handled that adeptly.

5200.9 of the Order changed some of the -- was it the -- how the money was allocated, what was financially feasible which it wouldn’t have been financially feasible in the past? Could you explain 5200.9 a little bit more.

MR. MARINELLI: I'll try. It didn't really change what was financially feasible because we had no numbers to apply to it before that. It established a financial aspect of feasibility to give our field people some guidance as to what's reasonable to spend on a runway safety area at a particular airport.

MR. GEORGE: Okay. So it established that. I think we all realize that our airports are all different to a lot of different extents. There's different number of operations, different size of airplanes, different numbers of passengers, and there's different kinds of obstacles or threats in the runway safety area, whether it's a river or a whatnot, a road. Does the FAA have any method of prioritizing RSA projects based on relative risk?

MR. BENNETT: Well, by selecting these 456 that didn't meet the 90 percent standards, we have put all of them in a group of priority projects. So we have done that. Within that, probably not formally, each Regional Division Manager knows his airports, knows which ones he considers important, is working with airport directors to know which projects are ready to go. Some will take more years, more environmental reviews. Some could be done more quickly. So there's a lot of things that might result in a project being done earlier rather than later without an analysis of the risk benefit of it. But eventually they're all targeted for improvement. So they're not left behind. It's just --

MR. GEORGE: Well, from looking through this, I find a lot of smaller airports and I don't want to hurt anybody's feeling if this is their hometown, but Roanoke, Hyannis, Massachusetts, Duchess County, Greenville, downtown South Carolina, Greater Binghamton, New York, these airports have had EMAS installed, and then we have such as, I don't want to say National because they have relatively standard, or at least some of their RSAs are relatively standard. Some of them are right next to the river, but you've got some others like say Midway. Midway seemingly was a high risk area where you've got very short RSAs, you've got lots and lots of traffic, and I was just wondering if the FAA had anything, any thoughts in there that we need to prioritize these based on the relative risk, and that's, that's not the case?

MR. BENNETT: No, I can't say that there are but, of course, on Midway, we had been looking at it since the beginning of the program in 2000. I'm guessing if you looked at those other airports that they were projects that were probably not difficult to do. It was an obvious solution. It was available, didn't require the developments and EMAS technology that we've seen in the last few years. It could be done with the original installation, and they were just available. It was a good project and it was funded.

MR. GEORGE: This is a similar question and I actually had Little Rock written here, but I scratched it out when you told me they were already -- reminded me they were already putting in EMAS there but Burbank, Teterboro and now Midway all had EMAS installed almost immediately following an accident, and my question is, does the occurrence of an accident move you up on the priority list of AIP funds or --

MR. BENNETT: Well, I don't think there's any question that we don't take a very hard look at an airport again when there is an accident to see what we could do, and I'm sure in each of these cases, there had been work done on it but that that harder look of whether a very innovative and non-standard solution was available, did come after the accident. And in Burbank, it really is in a very small area, and I think that was the first time that that had been done, and the question is whether that could be repeated elsewhere, and I don't think Teterboro's is in yet. They've just applied for it and are considering it. So that's fairly recent, and again we have some research going on at LaGuardia as to how close we can put the EMAS bed to the runway which is critical to determining whether it's feasible in an airport that does not have too much area off the end of the runway. So we will probably get the results of that, I would guess in time to benefit Teterboro and Midway and a lot more about those, the design of those projects as a result of the LaGuardia work, but that's all very recent.

MR. GEORGE: You brought up Burbank. Burbank is a non-standard EMAS. It is also right up next to the end of the runway. At the time, was there any provisions within the FAA to allow for a non-standard EMAS installation?

MR. MARINELLI: We consider a non-scattered EMAS installation, any installation that does not provide 70 knots stopping performance to the critical aircraft. I don't believe that Burbank is close to the runway. I believe there's a 75-foot setback there which is pretty much the older standard.

MR. GEORGE: But it probably does accept less than a 70 knot performance?

MR. MARINELLI: Yes, I'm sure it does and it was always our intention from the beginning when the Advisory Circular was first published that the 70 knot performance be a target but not a hard and fast rule. It was never intended that if you couldn't get 70 knot performance, you did not consider EMAS.

MR. GEORGE: It didn't have anything to do with if the FAA would pay for it or not, whether it had a 70 knot capability?

MR. MARINELLI: No, it never came into play.

MR. GEORGE: Okay. This is just kind of a general question about this. I'm trying to wrap this up so that I understand it. Is it possible that under the current FAA policy that some runways may be improved in some way but the RSAs will not meet the dimensional standards and that they will not have arrester beds installed and that those projects will be completed by the FAA?

MR. BENNETT: Yes, that's possible at the end of the program.

MR. GEORGE: Congress passed a law recently that in effect mandates all air carrier airports comply with FAA RSA requirements by the year 2015. I'm sure you know all about it. Will the FAA accomplish that mandate by the deadline?

MR. BENNETT: Yeah, that essentially duplicates our program. The mandate is, of course, on airports, not on the FAA but we already have the program in place and expect the funding. Obviously we don't do our own appropriation, but we assume the appropriation will make funds available for this, and I believe the law was actually based on the plan that we provided, that we completed in August 2005. So we think it's an overlay to the plan we have in place that will have airports obviously interested in completing it and working on those projects but there should be no problem completing it as required.

MR. GEORGE: This may be duplication of my other question. Will that law encompass or will it allow the same kind of airports that I mentioned a second ago or runway ends let's say, that will not meet dimensional standards and will not have arrester beds installed as well? Could a runway like that be considered completed and satisfy the intent of the law, the Federal law?

MR. BENNETT: Yeah, it's related to Part 139 standards. So it brings in that practicability consideration.

MR. GEORGE: Here's a theoretical question that we have from time to time. Can the FAA revoke Part 139 certification for an airport?

MR. BENNETT: Yes.

MR. GEORGE: Have you ever done it?

MR. BENNETT: No, we've suspended them.

MR. GEORGE: What was that for?

MR. BENNETT: It's basic Part 139 -- mostly operating conditions, availability of ARF equipment or management of the airport.

MR. GEORGE: So if you wanted them to put in an EMAS and they didn't want to, you couldn't force them by threatening to take their certificate?

MR. BENNETT: Refer that to a legal officer, in theory.

MR. GEORGE: Okay. Are you aware of any alternative aircraft arresting systems other than EMAS?

MR. BENNETT: Well, there are the military type arrester systems which are not used for civil aircraft.

MR. GEORGE: So for civil aircraft it's a no?

MR. BENNETT: I don't think we have any other commercial systems.

MR. MARINELLI: No, EMAS is all we have right now for arrestment of civil aircraft. I should mention specifically that EMAS is considered a generic term. It does not specify a particular product. So it is possible that another technology could come along. If it met the performance requirements, we would still call it EMAS but it would be an alternative, but as of now, there's really nothing on the horizon.

MR. GEORGE: The nature of my question was that I had heard rumor that there was something else out there, and I thought you guys would know about it.

MR. MARINELLI: There's beginnings of a proposal under the Airport Cooperative Research Program which is a new program that's really just fully funded this year, to propose a system that may show some promise but that would be years away from deployment.

MR. GEORGE: Thank you. I don't have any further questions.

CHAIRMAN ROSENKER: Thank you, Mr. George. We'll now go to the parties. Boeing, do you have any questions?

MR. SMITH: Boeing has no questions.

CHAIRMAN ROSENKER: Thank you. City of Chicago?

COMMISSIONER FERNANDEZ: The City of Chicago has no questions, Mr. Chairman.

CHAIRMAN ROSENKER: Thank you, Commissioner. Southwest Pilots Association?

CAPTION HEFNER: Southwest Pilots Association has no questions.

CHAIRMAN ROSENKER: And finally the FAA?

MR. WALLACE: No questions.

CHAIRMAN ROSENKER: I'm sorry. I missed Southwest Airlines.

MR. LOGAN: We had no questions anyway. Thank you.

CHAIRMAN ROSENKER: Thank you very much. I'm sorry I missed you.

We'll go to the Board of Inquiry. Dr. Ellingstad.

DR. ELLINGSTAD: Just briefly. Do you employ some formalized cost benefit methodology in terms of prioritizing?

MR. BENNETT: It's not really prioritizing, but in determining what we do for a particular runway safety area, how we determine what we will do, there's fairly clear guidance in Order 5200.9 as to how you do the cost benefit including life cycle costs.

DR. ELLINGSTAD: Thank you.

CHAIRMAN ROSENKER: Mr. Clark.

MR. CLARK: I have a couple. My understanding is that if there were major upgrades at an airport, the runway safety area improvement should have been included in that. It appears it wasn't. Is that correct? Two things. Is my statement correct that it should have been upgraded and that in fact it was not?

MR. BENNETT: At this airport? At Midway?

MR. CLARK: Yes, at Midway.

MR. BENNETT: There was major work done in 1993 when the requirement for upgrading, at the time when runway safety area work was relatively new. We don't have a record of consideration of that but, in fact, the solution, what we know 15 years later, is that EMAS, a non-standard EMAS is the only practical solution without acquiring blocks and blocks of city land covered by homes and businesses. At the time, EMAS was not available. The system didn't exist and would not have been considered. So in effect there was a practicability determination under Part 139 that found that nothing could be done at the time.

MR. CLARK: In 1993.

MR. BENNETT: In '93, and that's the last time that kind of work was done on air carrier runways at Midway.

MR. CLARK: And then you referred to distances off the end of the runway that, I think it was a 75 foot standard distance and new technology. Can you tell us a little bit about that?

MR. BENNETT: I could but I think you would be better off waiting for Mr. Thompson who would be able to address that.

MR. CLARK: Well, I’m going to ask how that affected the FAA operations?

MR. BENNETT: What it does for us is it allows us to put an EMAS about 35 feet from the end of the runway instead of 75 feet. So we get 40 more feet of arrester bed which makes a difference between it being a practical solution at Midway and not being a practical solution.

MR. CLARK: How much room do you have at Midway now?

MR. BENNETT: It depends on how it's measured. I believe we've got -- I'm not sure what the distances are at the end of the runway but there are navigation aids that have to be moved in order to make this possible.

MR. CLARK: Okay. But that 30 or 40 feet right now we can pick up some 100 feet or 200 or something out there, whatever that number is, and you're saying that the difference right now is to be able to pick up that extra 40 feet because of the new technology makes all this difference in the world or makes all the difference in making it practicable?

MR. BENNETT: According to our published guidance, yes.

MR. CLARK: Okay. Part of that published guidance -- well, let me go back to this 40 feet. I assume that's an erosion problem and there's a surface coating that minimizes the erosion?

MR. BENNETT: Right. It's a jet blast issue.

MR. CLARK: Right. For the kind of protection you can get from EMAS, is that 40 feet really that significant?

MR. BENNETT: All I can say is that according to our published guidance, which establishes, and it's not a hard number, but we generally look for a minimum of 40 knot performance before we consider it practicable to install EMAS.

MR. CLARK: Okay. So that's a lower number that's --

MR. BENNETT: Right.

MR. CLARK: -- affected. So if I buy my 40 feet, I get something over 40 knots then?

MR. BENNETT: That's correct.

MR. CLARK: You also mentioned there were some structure out there that had to be moved, antennas, is that still a requirement that type of material has to be moved to make it practicable?

MR. BENNETT: I believe so, yes. It may be possible to get the 40 knot performance without moving that navigation equipment but we can get even more if we do move it. So we've been working with our counterparts and other line of business and FAA to get that equipment moved.

MR. CLARK: Okay. But if you left that in there, and just ignored the fact that it was there, would you be able to gain that improvement from EMAS?

MR. BENNETT: I haven't looked at the design that closely to determine exactly what performance we would get up to the existing --

MR. CLARK: Well, I guess my question for the last six years, we were going to hit those antennas going off the end, so if we're in EMAS hitting those antennas, isn't that a better situation?

MR. BENNETT: I just can't answer that question. I'm sorry. I don't know.

MR. CLARK: You talk about your design standards and your performance manual, has anybody taken a look at those to look at, not the practicability, but some practical improvements that, you know, such as not worrying about the 40 feet or not worrying too much about some antennas that may be in the path of the airplane if it's going through EMAS? Is there any review in your standard going on right now to buy every single bit we can get out of those design specs?

MR. BENNETT: Well, I'd say given the fact that we're now seeing the second or third installation in a very small area, and it is presenting some special problems, that plus the new information we're getting from LaGuardia tests, we would do a change for that anyway because the setback is part of the specification, and if there's a minimum and it's lower than we have now, we would change our AC to provide that. If we find that there are ways for certain kinds of antennas to be incorporated into the EMAS bed and -- as a result of the Midway design work, then that would certainly get into our standards also but we haven't done the design work yet.

MR. CLARK: If you're going to hit it anyway, we might as well be using EMAS or if there's erosion, how much does erosion degrade in that 40 foot area, not accept erosion and still take some benefit out of that 40 foot?

MR. BENNETT: It's not just a question of some erosion. We had an installation at LaGuardia Airport that was completely destroyed.

MR. CLARK: Do you put any -- when you're trying to look at these airports, I heard earlier there were 285,000 operations at Midway, and I don't believe we come anywhere close to that, or Bridgeport or some of these other airports that were mentioned, does that move Midway to the top of the list in FAA's estimation for making improvements in these RSAs?

MR. BENNETT: Well, I guess that's really the same question. They're all going to be done. I mean every one of these runway ends are going to be addressed, and the reason Midway wasn't first wasn't because it wasn't looked at and discussed at length between the City and the FAA. It was because there just really wasn't an easy, practicable solution to the problem at the time when it was looked at. But within any region, the Regional Division Manager will know the projects that really -- he gets the most benefit from.

MR. CLARK: And then I noticed that you're going to start with 31C. Is that the most active runway at Chicago right now?

MR. BENNETT: I don't remember the numbers. Probably the people from Chicago would have more information on that but

I believe it is direction, that runway is one of the most heavily used at the airport.

MR. CLARK: Okay. Thank you.

CHAIRMAN ROSENKER: Thank you, Mr. Clark. Mr. Benzon?

MR. BENZON: Just a couple. You peaked my interest here when you said the unit at LaGuardia was destroyed. Was that because of jet blast?

MR. BENNETT: A combination of jet blast and I believe acoustic energy, just the low frequency vibration from the engines.

MR. BENZON: What other kind of maintenance problems have you run across with EMAS that may, well, may hurt it?

MR. BENNETT: Well, there's a history of development of EMAS. The original system required an -- paint which had to be reapplied on occasion. It also -- the seams had to be recaulked. The development of the system has progressed to the point where we hope that the next generation will not require any painting at all and will only require caulking of seams on maybe a three year basis.

MR. BENZON: That's the seams between the blocks of material you mean?

MR. BENNETT: That's correct.

MR. BENZON: Any -- now that would -- any moisture problems with these devices, underground water seeping in or anything?

MR. BENNETT: There have been instances where ground water or surface water does seep into the blocks but we haven't found it to affect the performance of the system.

MR. BENZON: Okay.

MR. BENNETT: I can add, I think the manufacturer would say that the system recognizes that there will be a high level of moisture in there, and it's built for it. It's built with drainage and the ability to withstand quite a lot of water.

MR. BENZON: Okay. I think we're going to talk with them shortly. So I'll ask them.

MR. BENZON: That's all I have, sir.

CHAIRMAN ROSENKER: Thank you. I just have one question and it may have been discussed earlier and I may not have heard it very well. Prior to December 8, 2005, have the City of Chicago and the FAA discussed EMAS at anytime?

MR. BENNETT: Every time there was a practicability determination, it was -- well, in the two that were done in 2000 and 2004, it was listed and considered along with every other option, and it was rejected as a standard option because there wasn't enough room for a standard EMAS installation.

CHAIRMAN ROSENKER: So are you telling me something significant has happened since December 8th and today that would allow that to happen, to be installed?

MR. BENNETT: I think the answer is yes, and it is the technology of getting a 40 knot plus performance system in an area that size, that that was really not just known to us at the time.

CHAIRMAN ROSENKER: So simply stated, the improvements in technology --

MR. BENNETT: Yes.

CHAIRMAN ROSENKER: -- and the manufacturing capability and ultimately the result now give you a capability that you could not have done prior to December 8, 2005?

MR. BENNETT: That's right.

CHAIRMAN ROSENKER: Okay. Thank you very much, and I appreciate your testimony and thank you for your answers as well.

And we will take a 10 minute break. Make it a 15 minute -- well, actually, it'll be a 12 minute break. We'll start at 3:15.

(Off the record.)

(On the record.)

CHAIRMAN ROSENKER: Mr. Benzon, if we could call the next witness from the City of Chicago please.

MR. BENZON: Okay. The Board calls Mr. James Sczcesniak to the stand please, and remain standing there, Jim, for a second. Please raise your right hand.

(Whereupon,

JAMES SCZCESNIAK

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

MR. BENZON: Okay. Please have a seat. We understand you have a presentation and before you begin, could you give us an idea of how long you've worked for the City of Chicago and in what capacity?

MR. SCZCESNIAK: My name is Jim Sczcesniak. I'm the Assistant Commissioner for Airport Planning for Chicago. I worked for the Department of Aviation for eight years. I spent six of that in airport operations at O'Hare and the last two in airport planning.

CHAIRMAN ROSENKER: Thank you very much. Mr. Sczcesniak, do you have a presentation before we continue?

MR. SCZCESNIAK: Yes.

CHAIRMAN ROSENKER: Thank you.

MR. SCZCESNIAK: Good afternoon. Today I'm going to give you a presentation regarding the runway safety areas at Midway Airport. In order to understand the runway safety areas at Midway Airport, you need to understand the history of Midway Airport.

Midway Airport was dedicated in 1927 in Chicago Municipal Field. By the 1950s, the Airport had 9 runways, handled 10 million passengers and over 431,000 aircraft. Midway Airport at this time was the world's busiest airport.

The picture that you see on the screen is actually a picture of Midway Airport circa 1937. You'll actually notice that through the center of Midway ran a railroad track. Okay.

Today Midway Airport is located within a vibrant community. It is surrounded by multiple residential and commercial developments just outside the boundaries of the airport. This picture shows you an aerial view of what Midway is. As you can see, all four corners have the land development constraints that have been referenced in prior presentations. But you can see from the original 1937 configuration, that one square mile configuration for the airport still exists today.

As the airport has evolved, and so has aviation, so have the standards that govern the airport. Runway safety area criteria prior to the 1950s was pretty much non-existent. In the 1950s, you get the predecessor to the runway safety area that extended somewhere around 200 feet off the end of the runway. Today that dimension is up to 1,000 feet.

Midway Airport is not unique in its ability to provide a full runway safety area. This inability basically exists at 300 of the 450 commercial service airports in the United States.

When looking at compliance alternatives, we used FAA Order 5200.8. Some of the options that are available to increase or bring the runway safety area to full standards are either a runway relocation or realignment, a reduction in runway length, a combination of the two, declared distances on an arrester bed system.

In September of 2000, the FAA and the City of Chicago worked together on a runway safety area determination. That determination found that there were no alternatives that were possible at that time to bring these safety areas up to full standards. In May of 2004, the City completed its own study. It came to the exact same conclusions.

In June of 2006, the FAA issued a new runway safety area determination that also found that it's not feasible to install or basically improve the runway safety area up to full standards.

This graphic represents a picture of a four runway safety area at Midway Airport. The area in red depicts the runway safety area outside of the airport boundaries that would be required. As you can see, it encompasses numerous residential dwellings, commercial dwellings, and then also major arterial roadways. Now this picture represents one corner of Midway Airport, but the other three corners are in a similar configuration.

So as we looked at the operations or at the options to improve the runway safety area, we looked at the arrester bed system as a way to improve the safety area inside the boundaries of the airport. A standard arrester bed system is impractical to install it at Midway due to the airfield constraints. The previous generations of EMAS would not have worked at Midway even in a non-standard installation.

By September of 2005, the FAA had actually just recently released a new FAA guideline in the Advisory Circular relating to EMAS. That gave better clarity to non-standard EMAS installations.

In the spring of 2005, new generation EMAS arrester beds had successfully withstood its first full year of jet blast and also weathered a full freeze/thaw cycle. With that added experience, in April of 2006, the Department of Aviation transmitted our preliminary study of arrester bed capabilities at Midway to the FAA, and then in June of 2006, the FAA has awarded us grant funding to do this and then also had changed the runway safety area determination to say that non-standard EMAS was a way to improve the runway safety area at Midway.

When we're trying to look at arrester bed technology, we look at LaGuardia as a good apple to apple comparison, as to what the conditions are at Midway. You have similar fleet mixes, similar weather conditions and similar setback constraints. In the fall of 1999, the EMAS was installed at LaGuardia with a 35 foot setback. By the winter of '99, that had begun to fail and then by the fall of 1999, the EMAS installation was actually removed. With the problems that were caused by the jet blast and the acoustics, the FAA, the manufacturer, and the Port Authority went back to the drawing board looking at ways to improve the blast mitigation of EMAS installation, and as I said earlier, in the winter of 2006, the installation at LaGuardia has survived and has also survived a freeze/thaw cycle.

Now when I'm talking about the EMAS installation at LaGuardia, you can see the pictures on the left depict the old EMAS installation. You can see that the area of EMAS was ravaged by the effects of jet blast. With a 35 foot setback and the fleet mixes that exist at both Midway and LaGuardia, that EMAS is subject to Category 5 hurricane winds on a regular basis as aircraft are departing.

The picture on the right depicts the new LaGuardia EMAS installation that had been installed for a similar time as the old one that has failed. As you'll notice, there is a remarkable difference in the existing EMAS installation that is there. It has been withstanding the jet blast and has been withstanding the weather.

So with the experience gained and with the knowledge gained at LaGuardia, at Midway now we are able to install a non-standard EMAS installation that will allow us that jet blast resistant coating, to install this non-standard with the 35 foot setback, and then we'll also work with the FAA to look at relocating the localizer to provide additional space for EMAS thruster beds.

So in closing, EMAS is the promising solution for

Midway to improve the runway safety areas. Right now we are currently in the process of working with the manufacturer and the FAA on planning, design and engineering on the installations. We are proposing that we are going to install one EMAS arrester bed by the end of 2006, and the remaining three will be in by the end of 2007.

That concludes my remarks.

CHAIRMAN ROSENKER: Thank you, Mr. Sczcesniak. We'll ask our Technical Panel if you have any questions. Mr. George?

MR. GEORGE: Thank you, Mr. Sczcesniak. I do have a couple of questions. Can you tell me what order the runway ends will be installed?

MR. SCZCESNIAK: The first end will be the 13C painted end, and we're going installing these based on order of the configuration usage. So that would be to protect on overruns of people arriving 31C. And then we would move onto the four right painted end.

MR. GEORGE: Could you discuss the RSA compliance alternatives that you talked about early on, such as shortening of the runways and using declared distances? Can Midway accomplish any of those or could you tell me why those aren't good solutions for Midway?

MR. SCZCESNIAK: Yes. When you look at the relocation or realignment of the runways within the confines of Midway, Midway is a square. So the longest distance you can get is the diagonal through the square. So that's why the runways are aligned like that. Being able to change that configuration is not a possible without shortening the runways. Declared distance is also a similar principal that would shorten the runway lengths and with that, you would have an impact to air traffic operations.

MR. GEORGE: Has the airport ever considered, and I know they have because we've talked, at what level did you consider acquiring land outside the airport in order to meet dimensionally full dimensional standard RSAs, and what, what would that cost?

MR. SCZCESNIAK: When we were doing our runway safety area practicability study, we looked at the ability to acquire the land outside of the airport. We were using FAA Order 5200.9 which was the -- what gave you the guidance on the financial practicability of RSA alternatives. We surveyed basically the neighborhood and came up with some, some numbers where we would have to acquire about 700 houses, about 130 businesses and relocate a number of major roadways, do some rail line work, all kinds of stuff like that, in order to provide a full standard safety area on the expanses of the airport. That was going to cost in land acquisition along was $300 million approximately and that didn't include all the road work, the rail work, relocation, environmental. So once we got to the $300 million, you can see that it's impractical.

MR. GEORGE: What will your arrester beds cost by comparison?

MR. SCZCESNIAK: We're looking at all four installations approximately $40 million.

MR. GEORGE: Could you summarize all the interactions that Midway's had with the FAA say since 2000, the runway safety area program and how the discussions went back and forth?

MR. SCZCESNIAK: Sure. Absolutely. Chicago's blessed because of the fact that we actually have our FAA Region located basically about a mile from O'Hare. So we have regular interaction with our Regional folks. I specifically actually sit in a meeting with them every Friday to talk about things. So RSA compliance is always one of our topics that we try and discuss when new things come, but as the previous speakers had mentioned, there was this point where we had looked at the options and there wasn't anything that was really available to us until you get this new technology with the new generation of EMAS. There was really this point where we had looked at the options, and we knew technology would ultimately solve our issues but it wasn't quite right there. I mean if you looked at the pictures from the LaGuardia experience, you could see that there would be no way we would be able to install all the old generation EMAS without it being destroyed also at Midway.

MR. GEORGE: So you have been in contact with the FAA pretty much constantly throughout this entire time. Is that what you're saying?

MR. SCZCESNIAK: Yes.

MR. GEORGE: And that's what my next question was going to be, when did you first start considering arrester beds?

MR. SCZCESNIAK: What we as the Chicago Airport System do, is we're a pretty regular participant at the Airport Council International. So we always reach out to our airline partners and airport partners and also to the industry. We are always watching the EMAS developments as they came along. So we've seen numerous presentations on it. We've seen it change over its years to see if it was improving, and that's why we always knew kind of the technology would eventually catch up to meet our needs.

MR. GEORGE: Did you ever have any dealings with ESCO prior to the last year or so, and going back 10 years or so say?

MR. SCZCESNIAK: Yes. I mean they have come out to the Department of Aviation I think to do some presentations and obviously we've had -- we've seen their presentations out at the ACI meetings and in the industry.

MR. GEORGE: This may not be a good question but I'm going to try it anyway. At the time prior to the FAA policy allowing non-standard EMAS installations, were you aware of other airports such as Burbank where they had non-standard EMAS?

MR. SCZCESNIAK: Yes, we, you know, obviously we talked regularly with our airport colleagues. We were aware of the installations that were at other airports but again when we were looking at or trying to do an apples to apples comparison to see the survivability of this product, we looked at LaGuardia as a very good comparable for Midway. Burbank with the weather conditions and the fleet mix, doesn't exactly mirror Midway. We looked at LaGuardia as the better comparison.

MR. GEORGE: And this is about EMAS in general and the desirability of such a system at an airport. Other than your initial cost, what are the downsides for -- let's say for Midway, life cycle costs, durability, maintenance? What adverse consequences to having that do you see at the airport?

MR. SCZCESNIAK: Well, it's going to require obviously a thorough maintenance program that we're going to have to go out and monitor on a regular basis. I mean it's a four by four cellular block that's caulked together. The caulking sometimes needs to be repaired to prevent water penetration. So that's the main maintenance issue. On occasion I think on the older generations of EMAS, even some of the debris that was thrown by the jet blast would damage the panels, but the newer panels tend to look like the jet blast hasn't impacted them. We actually did a field tour to LaGuardia about a month ago to look at their installation and to see how it has been holding up and the noticeable difference was that when you looked at the old pictures versus the new pictures, you could see that there's a very marked improvement.

MR. GEORGE: Probably the most important question, do you believe that the installation of EMAS at Midway will increase the margin of safety available for overruns?

MR. SCZCESNIAK: Yes.

MR. GEORGE: I have no further questions.

CHAIRMAN ROSENKER: Thank you, Mr. George. We'll go to our Parties. Boeing, do you have any questions?

MR. SMITH: Boeing has no questions.

CHAIRMAN ROSENKER: The FAA?

MR. WALLACE: No questions from the FAA. Thank you.

CHAIRMAN ROSENKER: Southwest Pilots Association?

CAPT. HEFNER: No questions.

CHAIRMAN ROSENKER: Southwest Airlines?

MR. LOGAN: No questions, Mr. Chairman.

CHAIRMAN ROSENKER: And finally, the City of Chicago?

COMMISSIONER FERNANDEZ: The City of Chicago has no questions, Mr. Chairman.

CHAIRMAN ROSENKER: Thank you, Commissioner. Thank you, Mr. Sczcesniak, for -- excuse me. I have to check with our Board. I suspect -- do they have any questions? Mr. Clark. Dr. Ellingstad has no questions.

MR. CLARK: I did note your one comment that it was certainly to your advantage to have the FAA so close by. I don't think I've ever heard anybody else say that before but I'm sure Mr. Wallace does appreciate that.

But a question along that line is what advice would you have for other airports that have a similar situation?

MR. SCZCESNIAK: I mean I think the advice I would have for airports now is that you need to make sure that you're following the updates within the industry. As we've been following these trends, you can see the improvement in the technology and an option that wasn't available to us in the past has now come to meet our needs. So other airports should also be continuing to watch this product as well as other products that might, you know, work at their airport.

MR. CLARK: But how would, I guess the -- as this thing developed starting in 2000, and there was one letter in 2004, one in what, 2002, it seemed like they were several years apart with some of the specific correspondence that dealt with improving the runway safety areas. Could that have been speeded up at all?

MR. SCZCESNIAK: Well, I mean I guess maybe it's something that's unique to Chicago was the fact that we have the ADO that is so close to us. So written correspondence might not be a good record indication of the work that went on because of the fact that we do see our FAA friends on a regular basis, basically weekly.

MR. CLARK: Okay. Thank you.

CHAIRMAN ROSENKER: Mr. Benzon?

MR. BENZON: Yes, sir. Since you've decided along with the FAA to install EMAS, have you thought ahead to long range upkeep and maintenance and would the airport have to do that or is that other contractors or the manufacturer would take care of that or how does that work?

MR. SCZCESNIAK: Actually again we're kind of -- the Port Authority of New York is kind of spearheading this, and they're working on a maintenance program with the EMAS manufacturer. We're going to follow the similar path. Because of the fact, remember, EMAS is a priority project that or product that they knew best. We as the airport don't. So we're going to need their continued expertise to be able to evaluate what, you know, that the product continues to perform and that it is maintained in a proper manner.

MR. BENZON: Okay. I've been hopping up and down here. So I may have missed this, but do you anticipate any problems with the installations when they get covered with snow, things like that? Are they going to be knocked about by your equipment perhaps or anything like that that worries you?

MR. SCZCESNIAK: Well, you know, we did talk with our counterparts at LaGuardia, and they did actually have their installation go through a major snow event this year with no ill effects. I think they had a snow event that had 18 inches, and the system held up.

MR. BENZON: That's all I have, sir.

CHAIRMAN ROSENKER: Thank you, Mr. Benzon. When did the LaGuardia put its new system into effect?

MR. SCZCESNIAK: July. I think it was July of 2005.

CHAIRMAN ROSENKER: So the technology was there perhaps before the December 8th incident -- accident?

MR. SCZCESNIAK: Well, again, it was one of those things, they installed it in July of 2005, but it had not proven itself in a winter environment that both LaGuardia and Chicago share. They, you know, somebody had to be first. They installed it --

CHAIRMAN ROSENKER: Was this considered a test bed?

MR. SCZCESNIAK: Yes.

CHAIRMAN ROSENKER: It was considered a test?

MR. SCZCESNIAK: Yes.

CHAIRMAN ROSENKER: Okay. And you are going to install it?

MR. SCZCESNIAK: Yes.

CHAIRMAN ROSENKER: When?

MR. SCZCESNIAK: The first one should be late fall of 2006, and the remaining three should be during the construction season or spring, fall, summer of 2007.

CHAIRMAN ROSENKER: Okay. Thank you, Mr. Sczcesniak. I appreciate your testimony and participation today. I appreciate your answers as well. And I thank you. We will excuse the witness.

(Witness excused.)

CHAIRMAN ROSENKER: And let's take a -- let's do a 10 minute break. We'll go until quarter of 4:00 since we're running at a nice pace. And we will then have our final witness for today in this topic, Runway Safety Areas at Midway and Other Airports with Land Use Constraints and we will then begin promptly tomorrow at 9:00. We're in recess for 10 minutes.

(Off the record.)

(On the record.)

CHAIRMAN ROSENKER: I'll ask everyone to take their seats please.

We'll begin with our final witness for today on the topic of runway safety areas at Midway Airport and other airports with land use constraints. Mr. Benzon, will you call the witness please?

MR. BENZON: Yes, sir. From ESCO, Incorporated, Mr. G. Kent Thompson please, and remain standing for a second, sir. Please raise your right hand.

(Whereupon,

G. KENT THOMPSON

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

MR. BENZON: Okay. Have a seat please. And we understand you have a presentation also, but first of all, could you tell us, spell your last name first, and then tell us a little bit about how long you worked for ESCO and what you do for them.

MR. THOMPSON: Last name is Thompson, T H O M P S O N. I'm the Vice President for Airport Engineering and Sales at ESCO EMAS division. I've been with the company for 22 years, about 8 years now working with the EMAS product and EMAS team.

MR. BENZON: Thank you.

CHAIRMAN ROSENKER: Mr. Thompson, do you have a presentation before we begin?

MR. THOMPSON: Yes, sir, I do.

CHAIRMAN ROSENKER: Thank you.

MR. THOMPSON: Okay. If I could start the presentation, first off, I'd like to thank you for the opportunity to be here.

Topics I'd like to cover briefly first include the overrun problem, why is there a need for EMAS, a brief overview of the EMAS product and our company's involvement in it, and then finally a bit about design of the product and its performance.

The overrun problem, there are about 10 overruns per year at airports in the U.S., and that's been pretty consistent over the last 20 years. Most of those overruns, about 70 percent take place during landing, many, more than half, involve contaminated runways. Many death, injuries and aircraft damage take place most often on the short safety areas that don't have an EMAS installed.

CHAIRMAN ROSENKER: Mr. Thompson, could you just get a tiny bit closer to that microphone please. That will help us hear you better.

MR. THOMPSON: Is that better?

CHAIRMAN ROSENKER: Much better. Thank you.

MR. THOMPSON: Thank you. Some of the recent overrun history are summarized here. You can see these include overruns both within and outside the United States. One of what we think is the very important thing when you look at the very unfortunate tally of casualties and aircraft destroyed is one that stands out is January 2005, Kennedy Airport, a 747 cargo plane went off the end of the runway at more than 70 knots and was safely stopped by the EMAS installed by the Port Authority there.

We've been working with the FAA for nearly 15 years in the ongoing development and improvement of this product. Our background, how we came to be involved is ESCO has been developing and making arresting systems for about 50 years.

Our experience comes from working with the military primarily, although we've done some special applications including backup system to catch the space shuttle if it has to make an unplanned landing. These systems are deployed in 70 countries and we're supplier to the Air Force, the Marine Corps, and the Navy. We started under a cooperative research and development agreement, started formal relationship working with FAA and this product development in 1994.

You might ask, what is an EMAS? We've heard a bit about it today but haven't talked too much about what it really is. It's a bed of jet blast resistant cellular cement blocks placed at the end of a runway to decelerate an aircraft when it overruns a runway in an emergency. It's a completely passive system. It's designed to reliably and predictably crush under the weight of an aircraft and that crushing, through that crushing decelerates the aircraft.

A little bit about how it works. It's principal is quite simple. As the tires crush the material, it creates a tire material interface at the front, at the leading edge of those wheels and that interface against the material provides the decelerated load, a drag load to slow the airplane down. That load's transmitted up through the landing gear and the support structure for the landing gear to decelerate and stop the aircraft.

A very important point here, it does not rely on friction to be able to slow an aircraft down. It's all this interaction with the material that does the job.

The system's tailored for the mix of aircraft of the runway, and we do that during the height of the system, depending on how big the wheels are, and what aircraft are in the mix.

When we're working with an airport and their consultants to design a system, some of the criteria, first and foremost, we try to maximize deceleration within the limits of that landing gear, and we use a computer model that's been validated through about 12 years of testing and R&D at this point. The model takes into account more than 100 different variables for each aircraft.

What performance you can achieve is really dependent primarily on how much space is available and what kind of aircraft you have in operation. We can vary the material properties in the system, essentially different strengths, along with the heights of the blocks, to maximize the performance of the system for each location.

And a little bit about the configuration. We're guided in our work with configuring the system by FAA's Advisory Circular for EMAS that the FAA folks discussed with you earlier today, AC 150/5220-22A, which is a performance spec and describe an engineered material arresting system which is the spec that our company's product has to meet. They also had and also talked earlier today about FAA Order 5200.9 which shows FAA's key policy in how EMAS is to be implemented and where it's cost effective.

Two different types of EMAS that you see. There's a standard EMAS which provides 70 knot performance and typically in that configuration allows 600 feet for the undershoot of an company and there's a non-standard EMAS which provides a minimum of 40 knots deceleration up to the 70 knot goal or non-standard could also mean there's less than 600 feet available for undershoots.

Typically the arrester beds set back from the end of the runway to provide a buffer for jet blasts. You saw some pictures that would show you why you would want to do that earlier. Fortunately, our development has brought us to the ability to put the system very close to the end of the runway now.

Typically it's the width of the runway plus step sides to allow easy access for fire fighting and rescue vehicles and you'll see those in a later slide.

The front of the system is ramped. This allows a smooth transition as the nose wheel and the main gear of the aircraft roll into the bed. It minimizes the vertical loads on the aircraft landing gear as it transitions and gradually goes into deeper material to bring the aircraft to a stop.

The back of the bed is the deepest part, and that's where you get a maximum -- the maximum depth, gives you the maximum deceleration for the plane.

There are currently 20 EMAS installed at 16 airports, 15 in the United States and 1 outside. A quick summary of those, you can see JFK International was the first system, the first prototype in 1996. We've got systems installed at Minneapolis-St. Paul, and at that point, you can see that the application started to gain more acceptance and was gradually used by smaller and smaller airports in addition to some of the larger airports in the country.

If you get down to near the bottom of the list, some of the most recent history, you can see was discussed earlier, two systems were installed at LaGuardia last year and that was a culmination of an R&D effort to prove the system could withstand and did withstand for several years jet blast very close to the end of the runway. So this was the completion of that program, and those two systems installed last year. Also a system installed at Boston Logan, at Laredo and earlier this year the first system outside the U.S. in a runway system at a tourist area in China.

Just to highlight the importance and the meaning of the non-standard EMAS, it's always an option. The FAA folks described the policy related to that already. You can see that there are already 13 of the systems, of the 20 systems out there are non-standard EMAS. The performance for the designed aircraft, you can see in those cases ranges from that minimum of 40 up to about 60 knots at the Fort Lauderdale with the 767.

Just a pictorial so you can see a couple of the recent installations, at Boston Logan, it's not hard to see why they might want to do that there, and the system is located in that case very close to the end of the runway and you can see there's water just beyond the end of the runway. The system in the other picture at Laredo, Texas, was recently installed and that gives you a look at those side steps that I mentioned earlier, so you can see how it's installed and how you would traverse to get on and off of this system easily.

You can also see, if you look closely, the pattern of blocks, 4 foot by 4 foot blocks, and the blocks are protected from the environment by a moisture seal in between the joints.

More installations are coming up soon. We're going to be doing another installation at this Zhiago Airport (ph.) in China later this year. Installation's coming up at Charleston, West Virginia, at Teterboro, New Jersey, another system at Boston Logan is planned for late summer this year, San Diego, and Madrid. It looks like we're working with the Spanish now on a design contract and will probably be putting two systems in there by the end of the year, and a system will be going in in Cordova, Alaska, next summer.

That picture by the way is at Binghamton Airport. It was mentioned before I think that it's not a real big, not a real busy airport but if you look at the picture, you can see why the need for an arresting system at the end.

A little bit about the successful arrestment history, besides the long test program with aircraft arrestments, that we did with FAA, since the systems have been installed, there have been three overruns, all successful. The first one in 1999, was a Saab 340 aircraft. The plane weighed about 22,000 pounds, went off the runway at more than 70 knots and was safely stopped at Kennedy Airport. In 2003, there was an overrun of an MD-11, a low speed overrun that came to a safe stop in EMAS, and then the arrestment I mentioned in January of 2005, of a 747 at Kennedy traveling more than 70 knots and landing in bad weather conditions.

We were asked by the NTSB to estimate what the performance of an EMAS might have been under the conditions of the overrun that occurred on December 8th of last year. What we did, we put in -- did a quick design simulation with EMAS at the end and we got data from the NTSB to use in the modeling exercise. The weight of the aircraft, about 118,000 pounds, the runway exit speed. There's a couple of different ways the data were reduced. One indicated 51, the other 53 knots. So we looked at both of those. The condition of max reverse thrust by the time the plane had left the runway end, and the point .08 breaking friction factor that you heard about earlier today.

The results of that simulation predicted that the airplane would be safely arrested within the existing runway safety area. The performance model indicated the plane would stop from 51 knots at about 198 feet from the runway end or about 206 feet from the runway end if the plane was going 53 knots. They key there is that it was stopped before it would reach the existing blast fence which is at about 229 feet from the runway end.

Just a couple of other points. The National Transportation Safety Board made two recommendations, not the only two, but two that I want to talk about in the May of 2003 requiring Part 139 airports to upgrade safety areas to meet the standards of the airport design advisory circular and highlighted that the idea that the upgrade should be made proactively rather than waiting for other runway improvement projects. They issued a similar recommendation in that report suggesting that EMAS be required on those runway safety areas that couldn't, with feasible improvements meet the minimum standards of the airport design advisory circular. And again, the highlight was the concept of going ahead and working proactively to do that rather than waiting for runway improvements.

The timing, you know, how the timing works, the FAA folks have already spoken to that. I think the Part 139 requirement is to do those improvements when the runway -- when there's major work on the runway to reconstruct or rehabilitate the runway, and that's been around for a while. FAA's current effort, the FAA flight plan, you heard the have a 2015 target for improving all the runway safety areas at the remaining deficient safety areas in the country's airports.

I just wanted to highlight that they do lack the formal, in my opinion anyway, they lack the formal authority to meet that date. I believe it would require a rule making or Congressional legislation to make sure that that happens. However, FAA has taken a proactive approach. I think they're doing everything that they can do to achieve that. They're working informally to encourage airports to be proactive and make those improvements and we see a lot of that taking place.

That concludes my presentation. Thank you.

CHAIRMAN ROSENKER: Thank you, Mr. Thompson. We appreciate your presentation this afternoon.

We'll begin with questions from our Technical Panel, and from Mr. George.

MR. GEORGE: Thank you, Mr. Thompson. I'm going to ask about the formal authority because I'm curious about that too. I asked the FAA earlier today what sort of authority they had and they assured me they had plenty. What is it that you're getting at with that lacking formal authority?

MR. THOMPSON: I think it's difficult for the FAA to pull somebody's Part 139 license. Just from my understanding, a Part 139, the clause that requires airports to upgrade safety areas when the runways are improved is pretty clear but I don't think there's anything in Part 139 that, that generates that proactive program. So FAA is doing it on their own, and I think they're working hard at it and it got a 10 year, 9 year remaining program to get all the runways done. But if an airport doesn't want to improve their runway safety area, I'm not sure that FAA really has a strong tool to make that happen.

MR. GEORGE: Is ESCO the only manufacturer and installer of EMAS in the world?

MR. THOMPSON: ESCO is the only company with a product that's been accepted by FAA.

MR. GEORGE: Do you know anybody else that makes a product that's not accepted by the FAA?

MR. THOMPSON: No, sir.

MR. GEORGE: You mentioned undershoot up there. That was -- I noticed that both standard and non-standard had a 600 foot limitation on there. So it sounds like undershoots are important. What would happen to an airplane, I mean what do you imagine, if you were to land in that or to land before that and come into the deepest part of the EMAS?

MR. THOMPSON: Well, FAA had some concerns about that early in the development of the system. What they did was at FAA's flight simulator in the Oklahoma City Test Facility, they ran a series of simulations, landing into an EMAS at different flap setting and different conditions, and their conclusion was that there was no loss of control of the aircraft. Basically you don't get that much strike compression when the plane is still flying to substantially penetrate the bed. So it skips off of the arrester system and at flying speeds, one skip and you're on the runway.

MR. GEORGE: You mentioned a lot of -- a couple of times in there about sealing the thing from -- the blocks from water and things. Is water particularly detrimental to the performance of the blocks?

MR. THOMPSON: Not so much the performance as the durability. Water and freeze/thaw conditions are the systems enemy in terms of long term durability. What we've done is we've created in the installation design a number of ways to make sure that water doesn't cause problems. We sealed the joints in between the individual blocks but at the same time, we leave spaces between the blocks and a ventilation system in the bed so that even if water does get in, it has a pathway to get back out.

MR. GEORGE: Do you have a ready made way to say check a block that's well on the inside, hard to get to let's say, on the bottom and see if it's taken up water or --

MR. THOMPSON: Sure, we do. There's a couple of ways we can do that. We did a series of tests a couple of years ago to try and really understand how much moisture does get in and what we did essentially going and putting a tube in between the blocks and penetrating the block and taking essentially a core sample of material out and then you can take it, dry it, you can measure the weight, you can dry it in the lab and weigh it again and find out how much moisture is in it. What we learned was that the systems tend to reach a certain equilibrium of moisture very quickly once they're installed, and it's an acceptable level. If moisture gets in, it tends to fall to the bottom and settle or run out of the system.

MR. GEORGE: This is going to be kind of a hard question and maybe unfair, but can you give me a ballpark estimate what standard EMAS 150 feet wide would cost to buy and install and also the same figure for a non-standard?

MR. THOMPSON: Sure. It can very quite a bit depending on what aircraft you have to design to stop but typically for a standard EMAS you're probably in the range of 3 to $6 million and for non-standard EMAS on the basis that the system is shorter, there's not enough space in order to get that 70 knot requirements it might be 2 to $4 million per system.

MR. GEORGE: How much of that --

MR. THOMPSON: It certainly can vary outside of that depending on other parameters but --

MR. GEORGE: I hate to dwell on cost, but how much -- what percentage of that is installation and how much is materials?

MR. THOMPSON: The materials would be, you know, the site preparation work is the biggest variable. The system itself, the blocks, the materials are probably 80 to 90 percent of the cost of what our company provides.

MR. GEORGE: Now here's my last question. What -- why was there an EMAS or EMAS needed at Laredo, Texas? That's just to satisfy my curiosity?

MR. THOMPSON: Well, believe it or not, they have airplanes down there.

MR. GEORGE: No, I was thinking of land use or land constraints.

MR. THOMPSON: They are constrained. I don't recall exactly what the constraint is at the end of the safety area, but they're able to get enough I think to get a standard EMAS but not enough to get a full 1,000 feet.

MR. GEORGE: Okay. Well, thank you very much. I have no more questions.

MR. THOMPSON: Thank you.

CHAIRMAN ROSENKER: Thank you, Mr. George. We will move to our Parties for questions, starting with Southwest Pilots Association?

CAPT. HEFNER: We have no questions.

CHAIRMAN ROSENKER: Thank you. Boeing?

MR. SMITH: Just one question and it's more of a curiosity than anything else. About how long does it take to install an EMAS system?

MR. THOMPSON: Typical installation time to actually put it in is probably on the order of six weeks. The biggest part is really preparing the site which in many cases might take a month to do. Actually installing the blocks is probably a two week process or so, two to three week process.

CHAIRMAN ROSENKER: Thank you. City of Chicago.

COMMISSIONER FERNANDEZ: As a matter of fact, Mr. Chairman, I do have a question. And it's really a two part. Mr. Thompson, if you could please discuss your commitment to support your product after installation? And the second part is, is there any ongoing R&D taking place that would increase the useful life and reduce maintenance?

MR. THOMPSON: Well, certainly we're committed to supporting all the installations and I think checking with airports that have installed EMAS, I think we've got an excellent record of doing that support. In fact, your question is a good one. We just recently released an upgrade to the system configuration, improved materials for the top protective surface of the system which should eliminate the need to repaint the system periodically, so that it will extend the durability and reduce the maintenance costs a lot.

COMMISSIONER FERNANDEZ: Thank you.

CHAIRMAN ROSENKER: Southwest Airlines.

MR. LOGAN: We have no questions, Mr. Chairman.

CHAIRMAN ROSENKER: And the FAA?

MR. WALLACE: Just a few. With regards to cost, Mr. Thompson, I heard many times in this room claims about how inexpensive certain things are, whether it's video recorders for aircraft or whatever. So we heard earlier that the City of Chicago expects to spend $40 million to do 4 runway ends and the FAA is paying a portion of that. So are those cost figures you said 2 to 4 I believe for a non-standard EMAS. What factors do those take into consideration in terms of things like moving localized antennas or whatever grading or construction is necessary?

MR. THOMPSON: The 2 to $4 million typically would be where there's not a lot of site preparation work required. So it wouldn't take into account moving of a localized antenna.

CHAIRMAN ROSENKER: I think you're not on microphone, Mr. Thompson.

MR. THOMPSON: I'm sorry. Is that any better?

CHAIRMAN ROSENKER: Much better. Thank you.

MR. THOMPSON: Okay. So the 2 to $4 million would typically be the system cost and the installation of the system and minimal site preparation work, you know. Would you like to ask anymore about that?

MR. WALLACE: Well, you heard the -- I assume you heard the testimony earlier today about the plan to install

EMAS at the four runway ends at Chicago, and this $40 million. Are you surprised it costs that much?

MR. THOMPSON: I'm not sure. I think the Chicago -- I'm sure the Chicago folks now the basis of that. We haven't gotten far enough into the design process with them to understand and to be working with that. The product part itself, the product and its installation would be considerably less.

MR. WALLACE: Okay. Thank you. Nothing further.

CHAIRMAN ROSENKER: Thank you, Mr. Wallace. We'll move to the Board of Inquiry. Dr. Ellingstad.

DR. ELLINGSTAD: You mentioned that essentially the sizing of the systems depend on the, the fleet mix that you have, and is this pretty much a dimensional difference or material differences depending on the size and weight that it needs to stop?

MR. THOMPSON: It's really both. In many cases, with larger aircraft, the material is typically going to be -- the blocks will be taller but in some cases the material will also be stronger. So it really varies with the mix of aircraft at an airport. If the mix of aircraft are all large aircraft, if there's no small aircraft to be protected, the strength of the material can go higher. If you're trying to cover a range that's going to protect small and large aircraft, then it might be lower and for all small aircraft it might be lower still, the block heights and the strengths.

DR. ELLINGSTAD: Okay. Is there a sacrifice of capability for smaller aircraft to the extent that you're designing for wide bodies for example?

MR. THOMPSON: There can be. Certainly to optimize for wide bodies would sacrifice performance for small aircraft. So it's a case by case decision and looking at the aircraft mix and what the priorities are for that airport.

DR. ELLINGSTAD: Okay. You mentioned that your principal or a significant part of your cost is the site preparation. In those cases where you have had the systems used, like at JFK, what does your replacement run?

MR. THOMPSON: Well, typically if there's an overrun into the system, you only have to replace the damaged portion which would be the wheel ruts and the area the aircraft travel. So in the experience for example of the 747, I think there was about -- I think it was close to a $2 million cost to replace the bed. That was the most extensive damage that any of the systems have incurred to date.

DR. ELLINGSTAD: Thank you.

MR. THOMPSON: Thank you.

CHAIRMAN ROSENKER: Thank you, Dr. Ellingstad. Mr. Clark.

MR. CLARK: Dr. Ellingstad raised the issue about repairs, and I'm interested in what does it take to affect a repair? What do you have to do?

MR. THOMPSON: It's really a straight forward process. The damaged material has to be removed and cleared from the area. Because the blocks are installed, they're pre-cast and they're already wrapped in this jet blast resistance coating system, they're ready to install when they arrive at the airport. So essentially the reinstallation of blocks in an area that has been damaged is done the same was as the original installation. The area is marked out in a grid and the blocks are adhered to the surface with usually an AC20 hot asphalt mix, and then the joints are sealed between the blocks. In fact, the latest joint seal for material which is an improvement over the caulk that was discussed earlier, it's another upgrade to speed a repair or original installation and reduce the ongoing maintenance costs.

MR. CLARK: Could that have also been the method to repair the erosion at LaGuardia?

MR. THOMPSON: It could be but that original bed, of course, in 1998, we hadn't developed the whole coating system at that time. So we really didn't know but, yes, the repair would have been similar. You would dig up with trucks, move out the material that was damaged and go back and place the individual blocks on the grid. The only difference in terms of installation, but it's a pretty big difference in terms of time and difficulty, is that at that time you had to install the coating system on the blocks after they were put in place and then paint it, whereas now everything is already prefabricated.

MR. CLARK: How would you handle a design around the issue of antennas out in the EMAS? I think we saw the picture that the gentleman from Chicago put up that showed a red antenna ray and the EMAS running up to it. Why can't we run EMAS right on through that and take full advantage?

MR. THOMPSON: It could be done. It hasn't been done to date. Normally the system is located up to the localizer, within a few feet, and ends there but it could be done. The difficult issue is, you know, one of the missions following the FAA's Advisory Circular is to minimize damage to the aircraft. So when we put -- if we put the system around the antenna, then we can't really predict what's going to happen in terms of aircraft damage when it hits the antenna, but it could be done. Basically you'd have to provide the drainage around the antenna location to get water that came in there out which is very straightforward and build the system around it.

MR. CLARK: Well, if you build an EMAS up to the antenna, the airplane is going to go through that EMAS anyway. It's going to hit the antenna regardless. So don't you buy extra protection by having EMAS all the way to the fence?

MR. THOMPSON: It certainly could provide extra protection particularly if the aircraft doesn't hit the antenna.

MR. CLARK: How close can you put EMAS up to the perimeter fence and have some advantage of the EMAS?

MR. THOMPSON: Any EMAS that you put in is going to provide additional stopping capability. You could argue that if you lose the nose wheel when you hit the localizer antenna, that having more EMAS behind it wouldn't do much because the nose wheel would be the device providing the braking and that part of the system unless it travels far enough for the main gear to go past the antenna but it's potential safety increase in any of additional length that you put in.

MR. CLARK: Okay. All right. Thank you.

MR. THOMPSON: Thank you.

CHAIRMAN ROSENKER: Thank you, Mr. Clark. Mr. Benzon.

MR. BENZON: Just a couple, sir. Did you say that the surface of an EMAS system can support a full sized fire vehicle?

MR. THOMPSON: Yes, sir. FAA did extensive testing during the early nineties and mid-nineties when we were doing aircraft tests at the Technical Center, and the normal process was after each arrestment to get a fire fighting truck out there and have it drive around not only on the bed as it's new, but in an actual rutted scenario. The vehicles are able to traverse the bed without even going to four wheel drive. They do damage the surface though. So you don't drive on it unless you need to.

MR. BENZON: They wouldn't get in there and get stuck?

MR. THOMPSON: No, sir.

MR. BENZON: The whole concept behind this device is to stop the aircraft without permanently damaging it or serious damaging the aircraft. Is that correct?

MR. THOMPSON: Well, of course, the most important purpose is to stop the aircraft and to protect the people on board but the secondary purpose is to minimize structural damage to the aircraft and that is codified in FAA's Advisory Circular.

MR. BENZON: Now during the design phase of this thing, was there any thought given to accepting damage to the aircraft so you could perhaps make the EMAS bed shorter and maybe stop the aircraft a little more violently but successfully and still save lives? Do you follow me?

MR. THOMPSON: Yes, sir, and it's something that still comes up occasionally on a case-by-case basis in looking at a particular airport's design because with the wide range of mix of aircraft, you want to get the best performance you can out of it. What you don't want to do, in some cases, an aircraft like a 737 is maybe a bad candidate for sacrificing a nose gear because the engines sit so close to the ground anyway that you don't want to give up that height. So you probably wouldn't want the design to fill in those gear to maximize performance but with some other aircraft it could be very desirable.

MR. BENZON: And you do it by just making the material more dense I suppose?

MR. THOMPSON: Or you could have the front edge steeper or faster to get up to maximum height or increase the maximum height.

MR. BENZON: Okay. That's all I have, sir.

CHAIRMAN ROSENKER: Thank you, Mr. Benzon. If I could go along the line of questioning that Mr. Benzon did. The minimal damage if you will to the aircraft, I heard some anecdotal evidence that in a number of cases you can actually pull these things out and with some inspections, they're airworthy again. Is that correct?

MR. THOMPSON: Yes, sir, I believe so. My understanding is that the Polar 747 that went off the runway at Kennedy last year at more than 70 knots, that essentially they replaced the nine tires and put it back in the air a few days later.

CHAIRMAN ROSENKER: And I see a picture here, I don't know if it's on your screen, a piece of that 747 it looks like with the nose wheel up, yet the land carriage itself, the wheel, most of the landing gear is embedded in this -- in the EMAS. Is that correct? Is that designed so that you don't get the nose wheel sheered off?

MR. THOMPSON: The design is done to minimize the risk of nose gear damage, and anything's possible in the real world.

CHAIRMAN ROSENKER: And what about the maximum speeds? I realize that each aircraft it would be different. What is the maximum speed you've tested these things at and had them successfully stop?

MR. THOMPSON: The highest speed of an actual aircraft would be the Saab and the Polar overruns which were both at or in excess of 70 knots, and they do cover nicely the spectrum of aircraft weights in use today. Beyond that, we've done testing with individual aircraft wheels in our various R&D tests, testing aircraft down to the 20,000 pound aircraft and below range, and successfully tested it at 70 knots.

CHAIRMAN ROSENKER: And you really want the main gear to sink in. Is that what you're trying to do?

MR. THOMPSON: Yes, sir. The main gear does the vast majority of the braking work for you. You have a lot more surface area in the tires. So when that's presented to the material, it provides a lot of, probably 80 or 90 percent of the drag.

CHAIRMAN ROSENKER: Now the more of these systems you make, do they get cheaper?

MR. THOMPSON: That's hard to say but we'll have to keep track in that.

CHAIRMAN ROSENKER: I don't care. I was just interested but I'm sure the FAA had some interest in that and maybe the City of Chicago.

MR. THOMPSON: It certainly helps with price stabilization when the volume is going up.

CHAIRMAN ROSENKER: Okay. Well, Mr. Thompson, I thank you for your testimony.

MR. THOMPSON: Thank you, sir.

CHAIRMAN ROSENKER: And I appreciate the opportunity to understand more about this system and its value.

(Witness excused.)

CHAIRMAN ROSENKER: I think we had a very good day today, a lot of excellent witnesses providing significant testimony in this hearing. Tomorrow we'll be dealing with Topic 3, aircraft landing performance including landing on contaminated runways, manufacturer's landing data, use of OPCs and use of thrust reversers.

We will have three witness panels tomorrow. If we move at the pace that we did today, I think we will have ample time to have a good discussion and yet still end this meeting without going above 5:00, and I will give everyone an hour tomorrow for lunch so they can look forward to that if we continue at this pace.

Tomorrow morning, we will reconvene at 9:00. Until then, the meeting will be in recess.

(Whereupon, at 4:30 p.m., the hearing was adjourned to reconvene on Wednesday, June 21, 2006, at 9:00 a.m.)

CERTIFICATE

This is to certify that the attached proceeding before the

NATIONAL TRANSPORTATION SAFETY BOARD

IN THE MATTER OF: Southwest Airlines Co., Flight 1248,
Boeing 737-7H4, N471WN
Chicago, Illinois
December 8, 2005

DOCKET NUMBER: DCA-06-MA-009

PLACE: Washington, D.C.

DATE: June 20, 2006

was held according to the record, and that this is the original, complete, true and accurate transcript which has been compared to the recording accomplished at the hearing.

____
Timothy J. Atkinson, Jr.
Official Reporter