UNITED STATES OF AMERICA

NATIONAL TRANSPORTATION SAFETY BOARD

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In the matter of:                   *
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EMPIRE AIRLINES FLIGHT 8284         *
OPERATING A FEDEX-OWNED ATR 42      *
(N902FX) WHICH CRASHED 300 FEET     *
SHORT OF THRESHOLD ON INSTRUMENT    * Docket No. SA-533
APPROACH TO RUNWAY 17               *
LUBBOCK INTERNATIONAL AIRPORT,      *
LUBBOCK, TEXAS - JANUARY 27, 2009   *
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National Transportation Safety Board
490 L'Enfant Plaza East, S.W.
Washington, D.C. 20694

Wednesday,
September 23, 2009

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

BEFORE: CHAIRMAN DEBORAH A.P. HERSMAN, Chairman
DR. JOSEPH KOLLY
MR. TOM HAUETER
MR. DARRIN BROADWATER, Hearing Officer

APPEARANCES:

Technical Panel:

MS. LEAH YEAGER, NTSB Sr. ASI, Office of Aviation Safety
MR. JOHN DeLISI, NTSB Office of Aviation Safety
DR. DAN BOWER, NTSB Office of Research and Engineering
CAPT. TODD GUNTHER, NTSB Office of Aviation Safety
MR. TIMOTHY BURTCH, NTSB Office of Research and Engineering
MR. JEFFREY MARCUS, NTSB Office of Safety Recommendations
MR. DON EICK, NTSB Office of Aviation Safety
MS. KRISTI DUNKS, NTSB Office of Aviation Safety
DR. KATHERINE WILSON, NTSB Office of Aviation Safety
MS. JENNIFER RODI, NTSB Office of Aviation Safety
MR. GUILHEM NICOLAS, BEA Accredited Representative
(Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile)

Parties to the Hearing:

MR. RICHARD MILLS, Empire Airlines
MR. DONALD FLANIGIN, ATR
MR. B. HOOPER HARRIS, FAA

I N D E X

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WITNESS PANEL #3: FLIGHT OPERATIONS AND TRAINING

Issue Areas: CRM, fatigue polices and guidance, training oversight/guidance, icing and flap anomaly training and procedures, simulator fidelity, training outsourcing

- Bill West, Managing Director, Feeder Operations - FedEx
- Captain Jerome Bonetto, Flight Instructor and Examiner - ATR
- Captain Steve Martini, Chief Pilot - Empire Airlines
- Harlan Sparrow, National Simulator Program - FAA

I N D E X

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P R O C E E D I N G S

(8:59 a.m.)

CHAIRMAN HERSMAN: Good morning and welcome back to the second day of this two-day public hearing. If I could remind everyone to turn off their electronic devices before we start or silence them, put them on vibrate. I think we're ready to begin with our second panel of witnesses.

Mr. Broadwater, go for it.

MR. BROADWATER: Thank you.

Would Mr. Phil Blagden, Mr. Don Stimpson, Mr. Didier Caihol, and Dr. Mike Basehore please come to the stand? You can remain standing.

CHAIRMAN HERSMAN: And, Mr. Broadwater, just to kind of clarify, we've sworn in all of the witnesses so far and so we're just continuing with that practice, correct?

MR. BROADWATER: That's correct, yes. Okay, if you could please raise your right hand?

(Witnesses sworn.)

MR. BROADWATER: Thank you all. You may be seated. Okay. And if you could please state your name, employer, and title for the record. And we'll begin at the end here with Mr. Caihol. Mr. Caihol.

MR. CAIHOL: Didier Caihol -- ATR since 1998 -- as Safety Director and also as icing expert. I began my career at Airbus -- in 1982 as Ice Protection System Designer, and I was working on the ice protection system design for the Airbus -- AC30 and AC40. Then I left Airbus to join ATR.

MR. BROADWATER: Thank you. And if you could pull the mike maybe a little bit closer to you?

MR. CAIHOL: Yes.

MR. BROADWATER: Great. Thank you.

MR. STIMPSON: Good morning. My name is Don Stimpson. I'm in the FAA, the Transport Standards Staff, in Renton, Washington, where we have primary responsibility for the standards, regulations, and guidance having to do with transport category airplanes. My primary area of responsibility is in the area of airplane performance and handling qualities. I've been with the FAA since 1991. I have a bachelor's and master's in aerospace engineering. Began my career at the Boeing Company in 1980 as a performance engineer. And as I said, I moved over to the FAA in 1991.

MR. BLAGDEN: Good morning, my name is Phil Blagden. I work for the European Aviation Safety Agency where I'm the manager of the large airplane certification section. I've held that position for approximately two years. I've worked for approximately four years for the European Aviation Safety Agency. Before that, I was a project certification manager for the UK Civil Aviation Authority for 20 years. I did my aeronautical engineering training with Rolls-Royce Aero Engine Company.

MR. BASEHORE: Good morning. My name is Mike Basehore. I'm with the FAA. I'm the manager of the Aviation Safety Information Analysis and Sharing Program. Prior to this, I've had previous duties as the manager of the Aging Aircraft Research Program. I've been the FAA representative to the NASA Aviation Safety Program and also the R&D manager for the Office of Aviation Safety.

MR. BROADWATER: Thank you. Madam Chairman, the witnesses have been sworn in.

CHAIRMAN HERSMAN: Thank you. Is the Technical Panel ready to begin?

MR. BURTCH: We are.

CHAIRMAN HERSMAN: Thank you.

MR. BURTCH: Good morning, Mr. Blagden. I believe you have a few slides to discuss the certification process. Could you present those?

MR. BLAGDEN: Okay, yes. Thank you very much. Could the presentation come up, please?

Okay. This is just a short overview of the certification process as it would've been conducted by the DGAC France back in the early '80s when the original ATR 42 airplanes were approved. And as you can see, brief overview of the ATR 42-320 model, high wing, short range, narrow fuselage, twin turbo prop airplane. The current responsibilities in Europe are held by EASA and an -- certificate has been issued based on the European regulation that empowers us to grandfather the DGAC certification. As you can see, the original ATR 42 was certified in September 1985 and the Model 320, which is the airplane subject in this accident, was certified in 1988. The current ER type certificate is derived from the DGAC certificate and includes the certification basis as originally defined by DGAC France. The FAA type certificate was issued through their validation process with the French authority, and if we can move on to the next slide, please?

Okay. So in the early '80s, the process within Europe was still run by the individual national authorities, although there were common certification requirements in the form of the Joint Airworthiness Regulations. JAR-25 was the applicable code for the ATR aircraft, and at the amendment level used for the ATR 42, it was derived from an integration of FAR-25 and national variance. Next slide, please.

Okay. The validation process that was followed by the JA and non-JA countries followed two fairly simple routes, depending upon the national authority concerned. In the most simple cases, the importing authority would accept the original certification basis without any additional requirements or more typically, and this was the case with the FAA. They conducted an evaluation of the state-of-design system, the state-of-design regulations, and the practical application of those regulations, and compared it to their standards and regulations at the time to determine a level of equivalency between the two airworthiness codes. The legal basis to conduct the validation is through the bilaterals that were in force between the U.S. government and the French government. Next slide, please.

The particular certification base is used by DGAC. As I mentioned before, it was JAR-25. In this case it was a Change 8, including an amendment, 81-2. The effective equivalent standard in the Federal Aviation Regulations is FAR-25 Amendment 1 through 53, but based on the date of application to the FAA, the effective requirements were Amendment 54, so the FAA developed a set of additional requirements which are listed in their type certification sheet. The DGAC, by virtue of their review of the design of the airplane, determined a number of special conditions and these are listed here. There are no special conditions that relate particularly to the requirements for flap asymmetry or particularly for icing. Next slide, please.

This just shows that the all weather operations, that's JAR-A0 for Category 2 operations was included during the certification of the basic airplane. And there was two equipment safety findings made, but neither of those related to the flap asymmetry or icing conditions. Next slide, please.

Okay, this is a particular requirement that relates to lift and drag device indication and to whether or not indication of the symmetry is required. 25699 in the JARs is taken directly from FAR-25699. There are no changes at all. This version of the requirement has been in place since, as you can see here, since Amendment 23 of FARs, and the same wording remains in place today. These requirements are not changed, either, in the developed European requirements, which is CS-25. Next slide, please.

Here are a list of some of the airworthiness directives that -- and modifications that were introduced following the investigation into the ATR 72 accident in Roselawn. I think these have been fairly well understood in the previous discussions with the NTSB. There's nothing here that I think needs particularly highlighting. Next slide, please.

And again, these are some additional flight manual changes. Again, all of the actions that have been conducted have been done both by the FAA and the DGAC, who were still the competent authority at the time of the accident and the subsequent investigation. That's all I have. Thank you.

MR. BURTCH: Thank you. I didn't hear it in your background, but were you personally involved with the certification program for the ATR at all?

MR. BLAGDEN: No, I was not.

MR. BURTCH: I'm going to simplify, I think, the slides that you presented here, but it sounds like the authorities do a comparison between Part 25 on this side; JAR

Part 25, for Europe, and the differences are then addressed by DGAC through the bilateral agreement. Is that --

MR. BLAGDEN: That's correct, yes.

MR. BURTCH: Once the differences have been established and we've nailed down the baseline for certification, is there -- what is the dialogue? Is it documented between the FAA and DGAC to oversee that testing?

MR. BLAGDEN: The normal process is that the FAA defines their certification basis through issue papers which are discussed between the applicant, ATR in this case, and the exporting authority, DGAC. As a result of the definition of the certification basis and the identification of any differences, then further issue papers would be raised, as necessary, to define the level of involvement that the FAA engineering team requires directly and the extent of any delegation that they would give to the exporting authority.

MR. BURTCH: Thank you. You mentioned that the comparison between JAR 25 and FAR 25 didn't show any differences in the area of icing or stall. Yeah, stall warnings, stick pusher, that area. I think that's the consensus.

MR. BLAGDEN: I didn't mention stall warnings, stick pusher. I described the flap asymmetry, lift and drag device --

MR. BURTCH: Okay.

MR. BLAGDEN: -- malfunction requirements and yes, Appendix C for the icing envelope is the same between the two sets of codes.

MR. BURTCH: I mentioned stick pusher because that's where I saw special condition, and I was curious, the details, for that special condition that applied for stick pusher.

MR. BLAGDEN: Okay. I don't have any backup material for that, but I can provide information subsequently for this.

MR. BURTCH: Thank you. Obviously, it was a part of this accident, so I'd be curious what that special condition involved.

MR. BLAGDEN: If that's acceptable to the hearing, we can provide some follow-up information.

MR. BURTCH: That would be great.

CHAIRMAN HERSMAN: That would be fine.

MR. BLAGDEN: Okay.

MR. BURTCH: There was also another special condition, C-6, for high lift devices. You had mentioned there was nothing, no differences identified for flap, but I did see the special condition for high lift devices, so again, that's an area I was curious if you had detail.

MR. BLAGDEN: I don't have copies of the special conditions with me, but I can follow up with that.

MR. BURTCH: Thank you. The original certification program versus what was done post-Roselawn, how did those two programs compares?

MR. BLAGDEN: I wasn't involved in either the original certification program or the post-Roselawn investigation, so I'm unable to comment on that.

MR. BURTCH: Maybe we can get someone to comment later on the panel. Thank you.

Both Captain Holberton and Officer Cornell, First Officer Cornell, described a situation where they knew they had a flap problem, the flap handle was down, yet the flaps were not down. But they were stuck, really, as how to proceed, they couldn't diagnose the problem, and it seems like we're in a Catch-22 there because they can't start down a checklist because they first have to diagnose the problem, but they couldn't see that problem.

Now, that situation in what you described, 25699, lift and high device indicator, high lift device indicator, how does that fit in to that regulation, that situation where -- I mean, Captain Holberton described it as an emergency situation, yet according to the FAR, which we certified the airplane to, there was not a condition there that needs an indicator.

MR. BLAGDEN: I'm not a flight test expert, but as I understood from the evidence that was discussed yesterday, the emergency procedure in the ATR flight manual is a common procedure irrespective of the cause of the flap failure to move to the selected position, and therefore, my understanding of it is it doesn't require a diagnosis of the specific cause of the flap malfunction to carry out the -- I believe that was the intent of the flight manual drill. In respect of the requirement, the requirement says that if you have a condition which needs to be -- a specific condition that needs to be identified in order that a discreet procedure needs to be followed to maintain the controllability of the aircraft, then you require an indication of that failure condition. The determination made at the time, as I understand, identified that there was controllability of the aircraft irrespective of the cause of the flap malfunction, and therefore it was determined that the discreet indication of flap asymmetry wasn't necessary.

MR. BURTCH: Yes. And that makes sense, from a flying quality/controllability standpoint, there didn't seem to be a problem. Maybe it's with the QRH where it said -- I know that Empire pointed out in the QRH how you needed to diagnose the problem first, and maybe we can get someone to come on from, maybe from ATR later.

MR. BLAGDEN: I can't comment on Empire's QRH.

MR. BURTCH: Thank you. Do you know of any other ATR anomalies experienced by ATR crews?

MR. BLAGDEN: By that do you mean flap asymmetries?

MR. BURTCH: Any flap anomaly.

MR. BLAGDEN: In terms of flap asymmetry events, there have been one other on an ATR 42 model, and there was a number, I think three or four, on an ATR 72.

MR. BURTCH: Do you have details on those, on the 42 in particular?

MR. BLAGDEN: I don't have details to hand, but we can give you a review of the event investigation.

MR. BURTCH: Thank you.

Madam Chairman, we have no further questions.

Next we have Mr. Stimpson, who is going to -- has a presentation on the specific compliance means for meeting the regulations.

MR. STIMPSON: Thank you, Mr. Burtch.

If we could bring the presentation up. What my presentation covers is a brief overview of what the certification requirements are relative to airplane handling qualities both for icing and for asymmetric flap requirement. This is for transport category airplanes covered by Part 25 of 14 C.F.R. Next slide, please.

So in brief overview, the icing requirement is covered in Section 25.14.19, and paraphrasing it here is that the airplane basically has to be able to safely operate in the icing conditions that are specified in Appendix C to Part 25. The words "safely operate" include consideration of airplane handling qualities. Similarly, the asymmetric flap deployment requirement, which Mr. Blagden showed in its entirety, 25699A, says that you have to provide an indication of an asymmetric flap deployment or any malfunction of flap system if it's needed to prevent or counteract an unsafe flight or ground condition, and that considers the effects of handling qualities on the airplane. Conversely -- or it implies that no separate indication is required if the handling qualities performance are not unsafe with the asymmetry. Next slide, please.

The way that we have applicants show compliance with those requirements comprise a number of different techniques and will depend on the specific certification program as to which techniques are employed and in which manner, but in general, we do flight test evaluations, this is the highest level. We look at things like how the airplane behaves in stall area. We look at general maneuvering capabilities, the turn-ability of the airplane, and we look at it in takeoff and landing. These flight tests are usually preceded by wind tunnel tests, simulator testing, and there's a degree of engineering analysis done with that data as well. Next slide, please.

For the un-annunciated asymmetric flap deployment, in order to show that that is not unsafe, we also typically see an engineering analysis and simulator testing of the asymmetry and if it's determined necessary, it may proceed to flight testing as well. Next slide, please.

Generally, how we find compliance with handling qualities, the considerations that we apply when we look at handling qualities issues, is we look at the performance of basic tasks throughout the flight envelope of the airplane, each flight phase, and the transition between those flight phases without requiring exceptional piloting skill or strength. That's really the standard by which it's measured; can you continue safe flight in landing with the airplane in that failure condition or in any probable operating condition. There are some assumptions that go along with that.

Number one, it is assumed that the airplane, at some point after the failure, will be trimmed to the extent that it's trimmable. And we also assume, and we check as well at the same time, the efficacy of the procedures that are involved with that particular malfunction. So we assume that once we check to make sure that the procedures are acceptable and can be readily followed, we assume that they are, and that includes such things as trimming the airplane and flying the speeds that are specified in the procedure. Next slide, please.

We do have some objective criteria that we apply in terms of force that the pilot needs to apply to the control to conduct the maneuvers. A lot of it is qualitative, and as we get to a point, though, where things may involve higher forces, we do have some guidelines to go by. These were the maximum allowable control forces for probable operating conditions that were in place at the time that the ATR 42 was certified. I can step through there just briefly. We have forces in each axis, pitch, roll, and yaw, and there is a recovery-type temporary force that once it can be trimmed out goes to a lower force for prolonged application. You wouldn't want the pilot to have to hold, for instance, 60 pounds in roll for a very long period of time. Next slide, please.

As Mr. Blagden mentioned, the original certification of the ATR 42-320 was on August 25th, 1988, for the FAA. It was done to Amendment 54. There was, following the Roselawn accident and in response to a recommendation from this Board, there was a special certification review done of both ATR 42 and 72 following that accident. It was conducted over a six-month period, involved several hundred man-hours of work, committee of 10, six from the FAA, four from the French DGAC.

The findings are summarized here, that the ATR 42 and 72 were certificated in accordance with approved procedures, that there were no unsafe or unique lateral control characteristics within the certified Appendix C icing envelope, but it was found through icing taker tests and through icing tunnel test that in freezing drizzle or freezing rain, there was a potential for a ridge of ice to develop after the icing boots that would lead to uncommandable aileron movement and subsequent high control forces which was implicated in the Roselawn accident, itself. Next slide, please.

So following that and following a series of ADs, which first of all took away ability to fly in icing conditions for a period of time, there were a series of other corrective ADs, one of which here is modified extended deicing boots were proposed for the airplane in 1995, and we conducted a certification program for those modified deicing boots. Not only did we want to look at did they succeed in ameliorating the problem of the ridge of ice after the deicing boots that was the issue in the Roselawn accident, we also, because of it's a change to the ice protection system of the airplane, we basically have to recertify the airplane to fly in Appendix C, within the Appendix C icing envelope as well.

So there was extensive testing done once again to certify the airplane for the basic Appendix C icing conditions, included wind tunnel tests as well as dry air simulated tests and natural ice in flight tests as well as flight tests behind the tanker, again, in -- at Edwards in California. In flight tests of the ATR 72 behind the tanker, it showed that in freezing drizzle and freezing rain conditions, the boots shed ice in the area that -- on the pre-modification resulted in the ridge behind the original boots and no ridge formed after the modified boots. We also confirmed that in the normal Appendix C icing envelope, we didn't get ice accumulating on the unheated side windows of the ATR 72, but in severe icing conditions we did confirm that that cue was present. Next slide, please.

There have been, of course, a number of amendments made since 1980s certification of the ATR 42. I think we're up to Amendment 129 now in Part 25. There are two in particular that affect, could affect the certification of an airplane in terms of handling qualities in general and also in terms of certification for operation in icing conditions. Amendment 84 was an amendment that basically harmonized with the Joint Aviation Requirements of Europe at the time in several areas. One of those areas was in those maximum control forces, the table that I showed you earlier.

It lowered the maximum roll control force allowable from 60 pounds to 50 pounds for the temporary application, and it also introduced an additional consideration of control forces that would be applicable to when you only had one hand available for control, such as during takeoff and landing where you may be operating the power levers. And then in 2007, just a couple of years ago, Amendment 121, which provided specific airplane performance and handling qualities requirements for icing conditions, and in general, it enforces the same handling qualities requirements in non-icing conditions to those -- to the airplane with ice accretions on the airplane. It didn't change the basic premise of Section 25.14.19 which says the airplane must be able to safely operate in icing conditions, but it did provide specific requirements that are an interpretation of the words "to safely operate" in terms of airplane performance and handling qualities. And I think that's the end of my presentation.

MR. BURTCH: Thank you, Mr. Stimpson. Mr. Caihol from ATR has -- we are going to start questions. Mr. Stimpson, the unsafe condition, I'm trying to reconcile that with the QRH still, and it sounds like by Part 25, both in the FAR and JAR, we're looking at an unsafe condition, an unsafe flying quality, it's flying qualities based. Is that correct?

MR. STIMPSON: It could be either performance or flying qualities.

MR. BURTCH: Okay. The engineering analysis for both -- let's look at the asymmetric flap. Is that typically done by analysis only or is some of that possibly flight-tested?

MR. STIMPSON: As I said, you can go to flight test if that's considered necessary. I'm not an expert on the 25699A compliance, that's not in my area. The area of my expertise is in identifying what flying qualities would be necessary to be considered not unsafe. We have done a review, however, of a number of programs in that area, and my understanding is that most of these are very, very limited levels of asymmetry that didn't rise to the level of requiring flight testing to show compliance.

MR. BURTCH: Thank you. Back to the certification process, this asymmetric flap condition, is this something that was considered no different than JAR Part 25 and therefore not addressed by DGAC? It fell under, they were similar to FAR and JAR Part 125?

MR. STIMPSON: The requirements are exactly the same. It means compliance were considered the same, and so compliance with the JAR 25 was sufficient to show compliance with Part 25. There were no particular issues on these particular requirements. We have the capability of raising questions and issues even where we have agreement, necessarily, in the regulation. If we have, for instance, a new interpretation required or a new design that we're not quite sure how it might fit in or if we have differences in the means of compliance, we also can raise an issue. In this case there was no difference.

MR. BURTCH: Thank you. To the forces, pilot forces, you showed a table that had five pounds, I think that was short duration. Five pounds prolonged, excuse me. What constitutes prolonged?

MR. STIMPSON: Prolonged, as I mentioned in the presentation, actually to tell you the truth, prolonged and the short duration, the temporary duration, there was a concern about the interpretation of that terminology, and in Amendment 84 when we changed the -- when we introduced the harmonization, we also changed that terminology to be more clear, and what was really meant there was that once the pilot has regained control and has the ability to trim those forces out, that's when the prolonged forces take effect.

MR. BURTCH: Okay. But it does assume trim and that seems to align with the testimony we heard yesterday where it's just a natural reaction, you automatically trim those pilot forces out?

MR. STIMPSON: Correct.

MR. BURTCH: The testing after Roselawn, is that beyond Appendix C?

MR. STIMPSON: There was testing done behind the tanker with different droplet sizes up through freezing drizzle, freezing rain. It was not done necessarily as a certification exercise in freezing drizzle/freezing rain; it was done to identify both cues, to identify where severe icing began, as well as to check the functioning of the modified boots as to whether they prevented the ridge from developing beyond the original boots.

MR. BURTCH: But it's not something they typically do adhering to Appendix C, correct?

MR. STIMPSON: That's correct.

MR. BURTCH: Do you know of any flap anomalies experienced on other flights, ATR 42s or 72?

MR. STIMPSON: I only know of the fact that there has been one other on an ATR 42, and as Mr. Blagden mentioned, three or four on ATR 72 which has a different flap design, different system design.

MR. BURTCH: Thank you. If we can move on to the next witness.

DR. BOWER: Mr. Stimpson, I have a few clarifying questions, please. In your presentation you had mentioned the handling qualities compliance for the ATR 42 at the time when it was certified, the performance of basic tasks without requiring exceptional piloting skill or strength. What's the metric used to define exceptional?

MR. STIMPSON: This is a subjective assessment by the flight test piloting team involved, and it involves their assessment of whether a pilot of normal skill, normal basic airman using basic airmanship, can successfully retain control of the airplane and maintain continuous safe flight in landing.

DR. BOWER: So it's subjective based on the flight test crew depending on whichever manufacturers perform that test, correct?

MR. STIMPSON: Right. Within the ramifications of, for instance, the assistance we give with the control forces capability and also look at basic requirements, that it meets the basic for -- or uses the basic FAR requirements as guidance to make that assessment.

DR. BOWER: Okay. And you touched on it previously with Mr. Burtch's question regarding the prolonged application time. I'm just curious in terms of what is the temporary application time for roll control force maximums?

MR. STIMPSON: Again, are you asking what -- would it be in minutes or seconds or --

DR. BOWER: Yeah, exactly. What's the guideline?

MR. STIMPSON: There isn't really a guideline in terms of the number of minutes but, you know, you could say that if it's going to be for a period of 10 minutes, you know that that's prolonged, but it's basically a dividing line as how long it takes to trim, to recover and trim the airplane out. It's a pretty short time.

DR. BOWER: Okay. And that would be for the temporary or in the prolonged?

MR. STIMPSON: That would be -- the temporary applies during the time of the initial recovery, and once the airplane is recovered and trimmed, then the prolonged forces are used.

DR. BOWER: Okay. And just touching on the special certification review in freezing drizzle/freezing rain, do you have an idea what sort of droplet sizes were used in those tanker tests to verify the boot extension?

MR. STIMPSON: No, I don't.

DR. BOWER: Okay. And you'd also mentioned that the Amendment 25.84 lowered the maximum control force level from 60 down to 50 and also lowered the maximum control when one hand is available, but do you have a value for what that was lowered to with the one hand?

MR. STIMPSON: Yes. The one hand was basically half of the roll control force for the two hands, so it was 25 pounds, and it was 50 pounds in the pitch force direction.

DR. BOWER: And at the time the ATR 42 was originally certified, the term "safely operate" was sort of left open for interpretation by the airplane manufacturer; is that correct?

MR. STIMPSON: Well, we had some guidance in there, what type of testing should be conducted.

DR. BOWER: And have those regulations since changed?

MR. STIMPSON: Yes, that's Amendment 121, puts in specific requirements for what is meant in terms of airplane performance and handling qualities --

DR. BOWER: Okay.

MR. STIMPSON: -- in icing conditions.

DR. BOWER: And those new requirements, are those for new airplanes or all airplanes?

MR. STIMPSON: Those are for new airplanes, but as with most new requirements, it's been an evolution for quite some time. In fact, at the time of the ATR 72 certification there was already the genesis of these requirements, and they were applied as a special condition for the ATR 72, and so a variation of these requirements have been applied since about that time. As we saw, I think, in the Colgan Air accident hearing, the Dash 8 was certificated to basically the Amendment 121 level even though that wasn't in effect at the time of the certification of that airplane.

DR. BOWER: And how do these amendments compare with regulations in other parts of the world?

MR. STIMPSON: The EASA has adopted the same requirements for Europe, and that's pretty much the extent of the other regulatory authorities that we have worked -- Transport Canada, as well, has taken pretty much the same stance. Those are the two that I know about.

DR. BOWER: Thank you very much. I have nothing further.

MR. BURTCH: If we could move on to the next witness. Mr. Caihol, I believe you have a presentation on the flap and stall warning system.

MR. CAIHOL: Thank you, Tim. So this is the first presentation I will run. This one is related to the flap and stall warning system installed in the ATR 42. So I will offer a quick overview first on the flap system and items related to the electrical commands, the hydraulic activation, the indications, the asymmetry detection, the performance of the activator, and how we certified the asymmetry. And the next part of the presentation, we'll give a quick overview of the stall warning system.

So, first of all, the electrical command. The flap position is selected through the handle inside the cockpit, and this handle transmitted the desired position to the flap control switch unit. That transferred this command to the flap board valve, which controlled the pressure to the activators, according to the feedback we see from the flap position sensor.

So here we are in the hydraulic activation part and you can see the four flaps, four different flaps, two inboard flaps and two outboard flaps, and there is one activator for each of the flaps. The control -- valve, the flap board valve, will receive the direct pressure from the -- circuits and control the pressure to each of the activators according to the -- position was the desired position. And the flap board valve transmitted the -- pressure to the extension line. This is red/brown line on the slide. And the blue line is the -- line towards the -- valve. The two inboard flaps are linked -- and each flap on the same side of the wing are connected with mechanical links.

So now we are in the cockpit, so you can see the two flight stations with the two control -- the various control system with devices related to the flap. First of all, the handle. The handle is located on the central -- on the right inside, and allow to select the position, the desired flap position. There are three -- positions, zero degree, 15 and 30, and in case of emergency, the flight crew can select the 45 degree position. There's also an indicator and this indicator, in through a needle that points out the selected, the position which -- with the flap, there are only four flap positions indicated, and this indicator is lighted at night for night vision of the position of the flap.

So now we go outside the cockpit and show the external marking related to the flap position. So this is a view from the cockpit side windows, and we'll have the same view on the two sides of the two-pilot station, so here you can see the propeller spinner and the wing leading edge and middle of the wing ledge and the flap fairing, and on the flap fairing there are external markings to show the position, the actual position, of the flap and in this case, the flap position that is indicated is zero. So the one -- can be lighted through the wind detection light for night operation and is visible at night.

So now we're coming back in the cockpit and maneuver the flap so the flight crew select the flap to the 15 position, for example, and the indicator beneath it will move up to the 15 degrees position when the flap will have reached this position. And the associated external marking where the marking indicates the 15 degree position has been reached by this flap.

So now some more description of the asymmetry detection. Everything is installed on dock tube, and the dock tube is linked, connected to the in-dock flap, the left and the right-hand, and the positions is installed in the middle of the dock tube, and it provides the position of the flap. And at one end of the dock tube is installed the detection unit for the flap asymmetry that triggered upon a specific threshold and in this case, in the case of the ATR 42, the asymmetry was triggered when there is a difference in position between 8 to 10 degrees between the flaps. And as soon as the asymmetry is detected, electrical signal is sent to the flap system activation, and the electrical supply is shut off and the flaps are frozen in that position.

So now the actuator performance, so here is provided the -- force or the required force to move the flaps to each position and this forces are to be compared with the -- forces at -- pressure and generated by direct pressure coming from the -- so we can see that the -- forces is roughly four times the force required to move the flap to the 15 position, so we have a lot of margin on each actuator.

So the asymmetry certification, so we have designed the flap system to detect the asymmetry very soon and block the flap and prevent this situation deblocking in unsafe condition. And so we have run -- to determine the threshold, we have run dedicated tests -- to appreciate the degrees of asymmetry and we have run -- and performed also flight simulator -- and we have demonstrated that there were no unsafe conditions upon asymmetry, as when the asymmetry is permitted to that value. And this demonstration has been agreed by several authorities.

So what happens in the case of flap asymmetry, we are coming back in the cockpit. So the flight crew will select the desired position. In this case, it will be 15 degrees -- and the needle on the flap indicator will start to move, leaving the zero position and going to the 15 position and as soon as the asymmetry will be detected, the needle will stop and will indicate that the flaps are jammed. And the asymmetry lift induced by the -- extension of one flap induce rolling moment.

Now the same case under -- so we have the handle position of 15 degrees and the flap needle indicating 5 degrees, so the flap have jammed in this position. And to control the difference in lift on this wing, this autopilot driver -- input to control the roll and this -- through the rotation of the control wheel. In the case of the Flight 8284, we had the rotation by 20 degrees to the left and this is maintained by the autopilots. And then we have a light on each side of -- that tells the crew that there is a message on the radio and that this message tells the flight crew -- roll -- and tell the flight crew that they have excess load on the control wheel and the flight crew have to trim the aircraft to cancel the load.

So now some more -- from the interpretation system. The interpretation includes the stall warning and the stick pusher, so all the warning -- by the crew are left in the computer is still in the cockpit that received the information from both the electrodes on each side of the aircraft, and the crew -- computer will operate the stall warning and stick pusher according to the aircraft configuration and whether the aircraft is flying in icing condition or in clear condition.

So the stall warning include the stick shaker and is demonstrated to the flight crew shaking the stick and a dedicated sound, the cricket sound, and deactivate the autopilot if the autopilot was engaged. And we have two different thresholds, for example, for the flap 0 and 15 position, the clear -- a condition of clean aircraft condition for the stall warning is 18 degrees, roughly, and in icing condition, 11 degrees, so this angle of the wing angle provided by the AOA. That ends my presentation.

MR. BURTCH: Thank you, Mr. Caihol. Very informative. I'll start with the previous ATR 42, if we'd just speak to any previous 42 accidents because of the different flap systems. I've heard of one so far. Do you know of any others beyond this one incident with the flap, the flap anomaly?

MR. CAIHOL: We have no records on flap anomaly on the ATR 42 basic. We have only one recalled on the ATR 42-500 that have comparable flap system, and it was a flap asymmetry.

MR. BURTCH: It was a flap asymmetry?

MR. CAIHOL: Yeah.

MR. BURTCH: And did you determine the cause of that asymmetry?

MR. CAIHOL: No.

MR. BURTCH: When a crew experiences a malfunction, how are the hydraulics reset so that they can change the flap position?

MR. CAIHOL: The flight crew cannot reset the position of the flap. The procedure is to the flight crew to move the handle to the frozen position indicated by the indicator. Then the flight crew continues its flight -- and its maintenance action to reset the flap installation in the flap system.

MR. BURTCH: Thank you. Can you describe any scenarios that could result in such a flap asymmetry?

MR. CAIHOL: On this assumption and according to the knowledge we have of the flap system design, so the first one would be a mechanical, excessive mechanical, friction on any part of the flap installation, so it could be either on the link or on the flap -- guides or it could be also a failure of one actuator and failure to move and that prevented the movement of the flap. It could be also a pollution inside the hydraulic line and especially on the retraction line, so the line that was shown to you in my slides and on one side only.

MR. BURTCH: Thank you. How does the crew eliminate that flap hinge fairing where we can see physically what the flaps are at, what the flap deflection is?

MR. CAIHOL: This light is mandated by the regulation, so I haven't -- the requirement that is the same on -- and this is called wind detection light. The first proposal of this light is to check the condition of the wing when entering an icing condition and this light illuminated the -- wing edge and the flap fairing. And there is one light on each side of the aircraft on the right-hand side and just in the middle of the --

MR. BURTCH: Thank you. You said the detector, the flap base symmetry detector, limits the asymmetry to 8 to 10 degrees.

MR. CAIHOL: Yes.

MR. BURTCH: And how is that set? I heard simulation, but the -- what's the basis? Was that modeling that you did in the engineering simulator?

MR. CAIHOL: Yeah. In fact, we have run various tests and wind tunnel tests relating the asymmetry of the flap, and it was determined that the -- threshold for detection would be between 8 to 10 degrees, so if we are to lower threshold, this may have triggered -- warning of flap extension. And above 10 degrees this would require a lot of -- input to control the asymmetry, so the asymmetry threshold to be determined according to the -- authority we have -- to account for this asymmetry.

MR. BURTCH: Thank you. And to go a little bit further with that one, the data that went into the engineering analysis, is that based on some asymmetric flap wind tunnel testing?

MR. CAIHOL: Yes.

MR. BURTCH: Okay. So that is from a wind tunnel test.

MR. CAIHOL: Yeah.

DR. BOWER: Good morning, Mr. Caihol. I have a few questions regarding the stall protection system. In your presentation you listed, for the stick shaker, two thresholds, one non-icing and one icing threshold. How is that icing threshold determined?

MR. CAIHOL: The icing threshold is determined at entry in icing conditions, so when the aircraft enter the icing condition, the flight crew has to select the Level 2 ice protection system, the electrical deicing, and through selection of the on deicing, there is a automatic decrease of the threshold and we determine that we are in icing condition.

In the case where the flight crew did not recognize the entry in icing condition and did not select this system, the ice detection system may detect ice accretion condition and remind the flight crew he has to select the Level 2 and the on electrical deicing and this will slow the icing threshold -- and there is a light in the cockpit, icing airway. That indicates the flight crew that it is flying in icing condition and that the minimum speeds you have to respect are the one related to the icing condition.

DR. BOWER: And in terms of the 11 degrees itself, how is 11 picked as compared to 10 or 12 or whatever?

MR. CAIHOL: I did not catch your question, sir.

DR. BOWER: You have an icing stick shaker activation angle of attack listed as 11 degrees and non-icing 18.1 degrees.

MR. CAIHOL: Yes.

DR. BOWER: How was the 11 degree picked for when in icing?

MR. CAIHOL: So, in fact, we have from flight testing simulated -- with simulated ice shapes installed on the aircraft and these simulated ice shapes was in the cycle ice shapes on the protected -- on the boots and the -- ice shapes occurred on -- and from the flight test pilot has performed several maneuver up to the stall and 11 degrees provides -- for the stall to occur in this -- aircraft condition.

DR. BOWER: And those simulated ice shapes, were they based on Appendix C?

MR. CAIHOL: Yes.

DR. BOWER: Was there any effort to examine shapes, SLD shapes or freezing rain or freezing drizzle shapes?

MR. CAIHOL: This was run later and so the criteria may be different. I'm not an expert in performance, but the criteria was different as it was more considered as a -- case shape -- so the criteria we have used is a little bit different. What we have checked with the simulated ice shapes related to SLD -- is more -- qualities and we have checked that the aircraft was free of any anomalies prior to the stall warning.

DR. BOWER: So during the special certification and the tanker tests where the extent of the boot was checked after it was increased there was no -- was there any effort to examine stall warning margin in those conditions behind the tanker?

MR. CAIHOL: The boot extension, the main proposal we'll see of this later with my second presentation, it was to address the -- formation behind the boots and the second -- we ran in the -- behind the tanker was to demonstrate the adequacy of the extended boots to prevent any -- formation behind the boots that may lead to -- anomaly.

DR. BOWER: And so in relation to natural stall, are the margins prior to -- or I'm sorry, let me rephrase that. The stick pusher margins above natural stall, are those set in the regulation?

MR. CAIHOL: I'm not a flight -- so I cannot answer to this question.

DR. BOWER: Okay. And also in your presentation, you show that the stick pusher activation was dependent upon flap position.

MR. CAIHOL: Yes.

DR. BOWER: In a situation like this where we have a flap asymmetry, what flap position will the stall protection system use when it's between zero and 15?

MR. CAIHOL: So it's dependent on the level of the indication provided by the central position still on the dock tube. In the case of the Flight 8284, the threshold of the one for the zero flap position.

DR. BOWER: Okay. That's all the questions I have.

MS. DUNKS: Good morning, Mr. Caihol.

MR. CAIHOL: Good morning.

MS. DUNKS: I just have one clarification question. On the incident that you were describing with the ATR 42-500, could you please briefly describe the circumstances of that event and if the crew was able to land the aircraft?

MR. CAIHOL: Yes. As far -- it was a ferry flight. This aircraft experienced an engine problem during the previous leg, and the flight crew was ferrying the aircraft to the maintenance station, and while in the crew's eye level, they selected the Flap 15 to slow the aircraft and they had a flap asymmetry that triggered. The aircraft was flown manually with the autopilot disengaged, and the flight crew re-trimmed the aircraft and engaged the autopilots and continued the flight up to the destination.

MS. DUNKS: Okay, thank you.

MR. BURTCH: We seem to want to ask a lot of questions about the ice protection system. Could you show us your presentation on the ice protection system?

MR. CAIHOL: Yes. So the ice protection system on the ATR 42-300, so this is a review of an ATR 42 where I will show you the -- ice protection system that are installed on this aircraft. So there are colored codes. So, first of all, I will begin with the red boxes and identify the -- electrically heated for ice protection. First of all, we have the windshield and the -- part of the side windows beyond the probes, so this include the -- probe, the angle of attack, the static probes and the -- sensor. The propeller blades are also electrically heated and the on deicing and you can see that through the -- deicing. This activates the icing -- to lower the stall thresholds. Then in blue, we have the automatic deicing, mainly boots, and first of all, we have the engineer intake and the -- deicer.

Then the wing -- including the outer boots and the -- boots and the -- stabilization. Then we have green boxes and the green boxes identify the various device available on the aircraft to appreciate and determine if we are or are not in icing condition and what kind of conditions are encountered. So, first of all, we have the ice events probe, then the wing detection light for which we had some words just before. The side windows dedicated to severe icing cues and the icing detector. The icing events probe is a small device that is installed on the lower side of the side windows, on the left-hand side, so this device is a small profile with small -- that is serrated, and this device is considered as being the first accreting ice and the last part where ice would shed. This device is visible from both crew station and is illuminated for night operation. On the right-hand side you can see the same device with ice accretion on its -- so this device, the primary function is to -- as it is considered as the last part to shed ice, so this device is monitored by the flight crew to determine if there is or not critical ice shapes or visible ice on the critical surfaces. And once this device is clear of ice, the flight crew can reset the icing -- and come back to the clean aircraft stall warning system.

And when this device is not installed, it's primary function is -- the ice detection system, so this is a well-known device installed for numerous aircraft, and on ATR it is installed in the middle of the left-hand wing on the lower side behind the outer boots and the -- boots. And this device sense the icing condition and trigger an icing signal when ice accrete on this small needle, on small sensor. And this device is part of the -- sorry. This device is part of the AS, so the AS mean advisory anti-icing system, so this system includes all the warning and lights provided to the flight crew to remind them that is flying in ice accretion condition and which -- they should select according to the sensed condition.

So the ice detection system, the ice detector, illuminate the icing signal just in the middle there, so it's a -- light associated to accretion warning to alert the flight crew that is in icing condition. We have the icing airway light that indicate to the flight crew when they related that they have to follow the minimum -- related to icing condition and the stall warning threshold lowered. And there is the deicing blue light that remind the flight crew that the boots are selected.

So the overall task related to the certification for flight in icing condition, so the main relevant paragraph of the requirement is JAR 25.14.19 and it's Appendix C, and the Appendix C define the -- condition to be taken into account during the certification process. And this, to show the compliance with this requirement, we have to perform icing -- test in simulated icing condition. We have -- to compute ice shapes using dedicated codes.

And we have installed these -- shapes on the aircraft and through the aircraft in various condition -- with the simulated ice shapes and we also perform flight test in the natural and measured icing condition. And this was to establish the minimum speed while in icing, to determine the stall warning threshold and stick pusher threshold, and establish the -- documentation and determine, appreciate the -- qualities and performance while in icing. And it was also used to determine the correct operating mode for the various deicing system.

Back to the overall description of the ice protection system. So we -- the initial certification modification and the most important modification were done after the Roselawn accident. So the first batch of modification was related to the extension of the outer wing boots and the intent of this batch of modification was to address severe icing including SLD -- so as a result of all the activity related to the Roselawn accident, we have performed two flight -- behind the tanker and as it was determined that SLD condition represent during this accident, we run the first campaign to determine what could be the effect of this kind of encounter on the aircraft and we determined that under SLD a ridge of ice may form behind the boots and change the instruments of the aileron upon variation of the angle of attack.

So we determined that we had to prevent such formation of -- ice and we have extended the wing boots, the outer wing boots, in front of -- and run again the flight test campaign behind the tanker and determine that these boots, as extended, prevent any ridge formation beyond the protected -- we also use this tanker test to establish also the visual cues as is shaped to such encounter, to assess the encounter, that we're well above the current -- regulation, Appendix C. And we also established positive means to recognize SLD conditions, and this include the side windows and dedicated also cues on the aircraft parts. And we also established a procedure to exit such -- when recognized and we updated our training materials, the Be Prepared for Icing brochure -- and implemented dedicated more -- so the side windows -- beyond the one that we are experiencing in icing condition, not normal icing condition such as Appendix C. And under certain condition, we also dedicated very specific ice pattern on the unheated part of the side windows and here we have example. On the right-hand side is what we are seeing behind the tanker so the ice is yellow because the water of the tanker was dyed.

And on the left-hand side is -- cues we had during natural icing -- we also determined secondary cues and this is also directly -- droplets of the Appendix C where we have larger, wider -- area. In blue you have the kind of ice accretion you may expect in Appendix C condition and the red box is the residual ice we may have on SLD condition. And here the residual ice covered the whole extent of the -- in blue, the one we have a typical Appendix C condition and in red, on the right, SLD condition.

So we had also a second batch of modification that were implemented after Roselawn, and this one was related to the median boots. And in this case, we have extended also the median boots at the -- of the outer boots to prevent any anomaly to occur before the stall warning, and the boots were extended to 12.5 percent. And we also updated the -- documentation to introduce the, what we call the minimum severe icing speed, so this is minimum speed to be followed by the flight crew upon identification of SLD condition and this minimum severe icing speed correspond to -- plus 10 degrees. And we also updated the cues related to SLD encounter and severe icing encounter and this include the speed decay while -- and the decrease of the rate of flying during climb. And we also associated and started to enroll -- anomalies to potential for severe icing. We also to update a little bit the flight manual after AD issued by the FAA that was addressing the absence of ridging condition and this AD asked to -- all the aircraft having -- to boots, the icing boots, to activate these boots upon entry in icing condition and -- sorry -- ice accretion was detected on the aircraft and -- the icing condition were present.

So all boots were already activated at first visual indication of ice accretion so we had to extend a little bit the duration for use for the boots until the end of the icing condition and this just was -- in 1999.

Based upon all the activity within -- after Roselawn, we had a very productive action -- towards our operation and we have shared our experience in various international -- related to icing in France and Europe, in the States, and we have also performed numerous tests on the different ice detection device addressing ice accretion. And what we have learned from our experience that are visual to establish adequate to address SLD encounter and to tell the flight crew when they are encountering the severe icing or SLD and that the aircraft can safely be operated in icing condition as long as the flight manual procedure are followed by the flight crew. And but we still understand that the crew, the awareness has to be continuously monitored and we have to have the flight crew to monitor the icing condition and is the reason why we have to continue our work and determine that the aircraft monitoring would be adequate to -- the crew awareness while in icing. That's it.

MR. BURTCH: Thank you again, Mr. Caihol. Very complete. There was a lot of icing systems on board there, but just to be clear, what was added after Roselawn was basically the boot extension where you went from 5 percent to 12.5 percent, and that was the significant change as a result of Roselawn?

MR. CAIHOL: Yes. This is the significant change on the boots, itself. Then the other change are to improve the crew awareness and the update of the limitation section and emergency procedure for address the severe icing encounter and the SLDs. And we also prohibit the flight in icing condition with the flap -- extended, to call it a case -- for Roselawn.

MR. BURTCH: Excellent. Thank you. So for SLD, it looks like you went beyond Appendix C, you did some SLD testing.

MR. CAIHOL: Yes.

MR. BURTCH: The AFM, does it allow flight into SLD conditions?

MR. CAIHOL: No. The limitation section of our flight manual describe the condition for which the aircraft is not certificated, establish the means to recognize this condition and how to let this condition --

MR. BURTCH: So you don't really take credit for that testing, you just -- you wanted to understand how the airplane behaved in those conditions?

MR. CAIHOL: Yeah, because the requirement issued by the FAA is through the -- ADs and shared by the -- was to first of all to address this condition, provide the flight crew with means to recognize this condition, then demonstrate and establish procedure to escape safely, so to escape safely we first have to understand what could be the behavior of the -- under this condition and establish correct procedure to escape safely when the effects of SLD on the aircraft.

MR. BURTCH: Thank you. The ice detector between the two boots, you briefly touched on that. How does that work or could you provide a little more detail there?

MR. CAIHOL: Yes. This ice detector include a probe whose diameter is a quarter of an inch and this probe is maintaining vibration at -- frequency and when the ice build up from this probe, this change -- frequency of the probe and any change in this frequency is analyzed and associated to ice accretion and the signal, an appropriate signal, is sent to the flight crew in the flight deck.

MR. BURTCH: Is that what triggers the chime and the light in the cockpit?

MR. CAIHOL: Yes.

MR. BURTCH: There were visual cues, the last few slides you went through, that showed icing and it indicated SLD conditions.

MR. CAIHOL: Yes.

MR. BURTCH: Does the crew really -- is that unique to SLD or might other icing encounters --

MR. CAIHOL: The main cue is the one of the signals while you're in flight, so this translate direct effect of SLD or larger drops inside the clouds, and they are secondary cues on the wide extent of ice accretion or ice formation on the spinner on the leading edge. And we have also visual cues such as water splashing on the windshield or side windows with outside temperature close to zero, zero degrees Celsius. And usually Appendix C condition are not visible and then you are not -- was not able to see the drops inside Appendix C clouds while you are in freezing drizzle or freezing rain, what was dropping -- around 400 microns and up to 2 or 3 millimeters diameter. The flight was able to see these cues and these droplets.

MR. BURTCH: Thank you. Last one. Ice evidence probe. I think, just to clarify, the accident airplane did not have the ice evidence probe installed; is that correct?

MR. CAIHOL: Yeah. The initial -- design of the ATR 42 does not include the ice evidence probe. The ice evidence probe was -- as an accessory on the ATR 72 because it has a longer fuselage and from the cockpit it's not easy to monitor the spinner, and this function on the ATR 42 basic is -- with a spinner. And it's later that we determined that the ice evidence probe was also adequate to monitor the accretion rate on the aircraft and it could be also considered as a first part to ice, that it has been introduced on all our aircraft and proposed to all the operators, so kits for -- have been sent to all the operator free of charge.

MR. BURTCH: Thank you.

DR. BOWER: I just have a couple of follow-up questions, Mr. Caihol. One point of clarification on the deice boot operation. What is the time between deice boot cycles when --

MR. CAIHOL: It's depending on the outside temperature, so for the ATR 42, when the temperature is below -20 degrees Celsius, the inter-cycle duration is four minute and when the temperature is -20 degrees, the inter-cycle is one minute.

DR. BOWER: And how long does it take a full cycle to operate all of the boots on all the surfaces of the aircraft take?

MR. CAIHOL: When you activate the boots, there are -- it takes about two cycle of activation -- because on each boot, we have two -- chamber, Chamber A and Chamber B, so we first activate the Chamber A for five second and Chamber B for five second, and we are covering the -- within 20 or 30 seconds.

DR. BOWER: And on Page 4 of your presentation you were mentioning that the minimum speed to stall protection were all verified within Appendix C icing conditions.

MR. CAIHOL: Yes.

DR. BOWER: However, were those minimum speeds and stall protection activation levels also verified in SLD conditions?

MR. CAIHOL: Yes. And the reason why we are requesting the flight crew to inspect -- speeds and add to 10 knots to this speed when they have identified SLD conditions have arisen.

DR. BOWER: Okay. So I guess that follows on to my next question in terms of that speed bump in severe icing. That was the basis of that 10 knot increase was --

MR. CAIHOL: Yes.

DR. BOWER: Was that based on flight testing or simulation or --

MR. CAIHOL: In fact, we have past evidence and verify that if the flight crew -- respected this -- it appeared that we would not have experience any anomaly on the aircraft.

DR. BOWER: For this particular aircraft? This accident or in general?

MR. CAIHOL: In general.

DR. BOWER: Okay. And last question. Was any sort of flap asymmetry addressed during initial icing certification?

MR. CAIHOL: The intent, in fact, of the flap asymmetry system is mainly to free the flap position as soon as the asymmetry is detected, so all the certification, first of all the design and then the certification was mainly to demonstrate that the asymmetry detection works and limit the asymmetry and prevent any unsafe condition to develop.

DR. BOWER: And in terms of this accident, we sort of have a combination of aerodynamic factors in terms of both evidence of icing and a flap anomaly asymmetry. Is this the first time ATR examined this combination of aerodynamic factors?

MR. CAIHOL: Yes. This is run and it can be run on the simulator by -- and as long as the minimum speed are respected, there is no change in behavior with or without outside icing condition.

DR. BOWER: I have nothing further.

MR. BURTCH: Madam Chairman, we have no more questions here. If you're ready for that break?

CHAIRMAN HERSMAN: Yes. Don't worry. You're still on deck, so we'll come back. I just think this panel might be getting a little bit long. We might need a little break. We'll come back at 10:45 in about 15 minutes, and we'll resume this panel.

(Off the record.)

(On the record.)

CHAIRMAN HERSMAN: Welcome back. Does the Tech Panel have any additional questions for the witnesses, or do you want to proceed to the next witness?

MR. BURTCH: We're ready to proceed.

CHAIRMAN HERSMAN: Okay. Mr. Basehore.

MR. BURTCH: I think we're going to go with Didier with ATR's aircraft performance monitoring system. Is that -- yeah.

MR. CAIHOL: So the aircraft performance monitoring. So this system was developed beyond any regulation and any requirement, and this -- proactive action to consciously improve the crew awareness, in this case who are while in icing. And once we have -- the system, it appeared that it was so responding to the several recommendations issued by investigation authorities on all the aircraft and that it was addressing the NTSB recommendation that was analyzed through the -- rulemaking activities, mainly the ice protection -- working group.

So the intent and objective of the aircraft performance monitoring was to provide information to the flight crew of the performance degradation and also details of the current aircraft speeds in respect with the minimum icing speed. And the aircraft performance monitoring elaborate advisory signals to improve the crew while in icing.

So the APM -- the APM use the flight data recorders parameters and the aircraft weights -- by the flight crew to real time compute and compare the expected performance with the actual performance of the aircraft, and it also compute the minimum icing speeds according to the aircraft configuration and also computes the aircraft weight during takeoff and initial climb in the case where the flight crew has not selected the right weight. And according to this information, the APM elaborates regular signals at -- threshold according to the performance degradation. The APM is active during the entire flight from takeoff to landing, but it only delivers audits to the crew only when the flap and the gear are retracted -- operating, the static air compression is lower than 10 degrees Celsius and icing condition are present. And icing condition means -- two or three of the ice protection system are engaged or the icing signal is given by the ice detector.

There are three level of signals. The first signal is -- low; the second one is degraded perf; and the third one is increased speed. The cruise speed low may not trigger and will not trigger during descent and climb, while the three signal may trigger during cruise level. First signal is a speed not -- advisory signal and it advise the crew that the aircraft has some drag and that the cruise speed is lower than the expected one by 10 knots. And upon activation of the signal, the flight crew has to monitor the icing condition and speed.

Second level of signal address the performance loss, the degraded performance, and it's associated to -- and the single chime, and this signal appear in climb, cruise, or descent when the performance has been degraded, such as speed decay or rate of -- decrease. And the -- cause for such degraded performance could be an abnormal ice accretion. Upon degrade performance activation, the flight crew has to check if the ice protection system is selected on. He has to apply, as minimum speed, the -- and disconnect the autopilot, and then check for the presence of severe icing and mainly for the cues, and he's checking -- and he's maintaining the speed -- turn and check with the autopilot off for any abnormal -- condition. If there is no evidence of this condition, that mean that the aircraft is not flying in severe icing, but if one of these conditions is present, he has to apply the severe icing procedure and exhibit this condition. And if not, he can continue the scheduled flight, still monitoring the speed and the icing condition, and the autopilot can be reengaged. Next step is the speed audit.

This light is flashing and associated to the caution lights and the single chime, and it alerts the crew that the minimum icing speed is reached and below the red -- turn, and when this message trigger, the flight crew has to increase the speed. And to do this, he push on the stick and apply the severe icing procedure. So now we are back in the cockpit to just show where are the devices related to the performance monitoring in the cockpit.

So we have the three lights, cruise speed, low degrade perf, and increase speed install on the upper part of the -- shield on each side of the cockpit in front of each of the pilots, and on the right-hand side in front of the first -- we have the selector for the weight, I think with 12 different position. And the weight is selected before the takeoff and the weight automatically compute according to the fuel consumption during the flight. So now the APM validation, so we have to perform an extensive test campaign during the 14 months covering 2,500 flights where we encounter the strong winds and -- of winds and icing condition. And we also run afterwards the APM on past severe icing encounter and determine that the APM -- for time replication of the procedure. We also run the APM for the Flight 8284, if it was installed, using the ATR data, and it's appeared that cruise speed low would have been triggered during the first icing encounter at flight level 180 and this after 10 minutes at this level.

During the second icing encounter, the cruise speed low would have triggered 70 seconds before the flap extension and -- the degraded perf 40 seconds before the flap extension. So the -- of the APM, this is a change that has been approved by -- on July 2005 and this include -- in the associated manuals, and the APM is installed on all production aircraft since November 2005 and service bulletin is available -- and offered to all the ATR operators since June 2006. And we are also -- retrofit airplane on our -- during pre-delivery rehearsal.

And today we have roughly 250 aircraft equipped with the APM. We have also conducted the worldwide promotion -- the authorities, such as the French JC, the FAA, and -- and it was determined that it was more appropriate to detect the effect on the aircraft -- the condition itself. And similarly, we have promoted the installation of the APM to all the operators and promoted this system during numerous operator -- conference and also presented this system to different international committees.

MR. BURTCH: Thank you, Mr. Caihol. So the system, how many parameters -- just some idea of what's required in terms of instrumentation for this system with the icing, icing only, to monitor for speed low performance, approximately how many parameters do you require?

MR. CAIHOL: There is no dedicated parameters; the only one is the weight. All the other parameters are recorded in the -- so already available on the aircraft, so there is no dedicated instrumentation. And we need parameters related to the flight condition, I mean, the altitude, the speed, and the temperature, and the parameters related to the -- installation to determine what is the aircraft -- delivered by the engine and the propeller, and also the flap condition.

MR. BURTCH: So for a retrofit, it's relatively easy. There is the weight input that's required and the instrumentation, but the parameters are floating around the airplane already; is that correct?

MR. CAIHOL: Yeah, most of the parameter are already available on the flight -- condition units that provide the -- to be recorded to the FDR.

MR. BURTCH: Does the system require accurate weather forecasts or PIREPs or --

MR. CAIHOL: No, it is -- systems working alone, and there is no human input from inside for weather forecast. The only input is the weight on the aircraft.

MR. BURTCH: Right. The models that are behind APM, are they the same models that you used for the performance analysis of this accident as well as simulated models for training and so forth, something similar?

MR. CAIHOL: Yes. In fact, the model that is included in the APM, the draft engineering software, we are usually using for the performance --

MR. BURTCH: So it sounds like there's a lot of reuse here, you can reuse parameters that are in the airplane, you can reuse the models that you have already developed; is that fair?

MR. CAIHOL: Yes.

MR. BURTCH: I was happy to hear yesterday, Empire mentioned that they were looking at this system, along with FedEx, as the airplane owner. And they also mentioned the problem of volcanic ash; they operate in a lot of areas that are impacted by ash. I'm wondering if this system or you foresee this system being expanded? Really, any performance degradation could potentially be detected with this system, with the right threshold set and testing, but things like aging aircraft, volcanic ash, beyond the icing threat, do you see those as possible areas where this system may be expanded?

MR. CAIHOL: Yes. As long as the performance has degraded by any -- for any reason, this could be detected by the APM, so the crew application limits the performance stipulation to icing condition, but it could be extended to other reason of performance degradation.

MR. BURTCH: And I think you said that there is no requirement for this system; is that correct?

MR. CAIHOL: Yes.

DR. BOWER: Just one quick question, Mr. Caihol. Have you gotten any feedback from customers who have the system installed in terms of how many times they get alert, may pop up or not?

MR. CAIHOL: Yes. We had feedback, so the operator -- reporting the correct operation of the APM because they have the first signal or second signal, but it's not considered as a failure, so it's normal operation of the system, so we -- feedback from the operator, yes.

DR. BOWER: And overall, has the feedback been positive?

MR. CAIHOL: Not all the feedbacks are positive. As using several parameters, you may have some fault of the system when one parameter is missing. In fact, it's monitoring the parameters recorded in the ATR, so if there is one parameter -- that is not -- to trigger fault in the APM, so it is not all positive, just have to try to improve the reliability of the parameters that are used.

DR. BOWER: Thank you. That's all I have.

MR. BURTCH: We're ready for the next witness.

Dr. Basehore, you had a presentation for us. Could you begin?

DR. BASEHORE: Yes. If you could queue that up, please. I'd like to give just a brief overview of the Aviation Safety Information Analysis and Sharing Project, which will be known from now on this presentation as ASIAS. Could I have the next slide, please?

I want to briefly state what ASIAS was and what it is not. ASIAS is a collaborative program between industry and government, not only the FAA, but we also have representatives from NASA and the Department of Defense actively working with us. Industry partners include airlines, labor unions, manufacturers as well. And its intent is to proactively discover systemic safety concerns, that is safety concerns across the NAS and proactively identify them prior to them leading to an incident and accident and therefore being able to mitigate those concerns. What ASIAS is not is an on-flight, local, real-time, automated detection diagnosis/prognosis of an adverse effect that's occurring in-flight. So it is not similar to the APM that we just heard described. Can I have the next slide, please?

So the objectives in ASIAS is to create an environment that we can easily share data amongst the stakeholders. That environment would be, for example, the Voluntary Disclosure Reporting program and FOQA program, ASAP programs, as well as a means to share that data amongst the stakeholders in a de-identified and protected manner. How we would establish an architecture of how we would acquire and get access to that particular data? Enhance the value of existing data sets. Some of the data sets that are out there were developed quite a long time ago when there was no intent to actively query those databases. For example, when ASRS was established, it was sort of a recordkeeping, but there was no intent to actually look across years and look across particular types of events.

Acquire new tools or develop tools, we look across the industry and see what tools are already out there, what -- software tools, analysis tools are available that we can apply, as well if the methodologies don't exist such as auto-classification and text reports, then we'll develop them in the ASIAS program. And probably one of the key things that support safety analysis initiatives, one of the things that ASIAS gives us as we complete a study, that information is then handed off to an organization that can go about and provide the mitigations and safety enhancements. The next slide, please.

So we are governed by some formal principles, and as you see here, primarily the most important one from our stakeholders is that the data is used solely for the advancement of safety. We do not use the data that -- in ASIAS for any oversight or enforcement activities. It is strictly for safety. For those folks that participate, the voluntary submission of safety sensitive data is endorsed, for example, if you are part of ASIAS and contribute FOQA data, that meets the -- you will be protected under the FAR 193 voluntary protection program. All carrier, original equipment manufacturers, maintenance repair operations data is de-identified.

Transparency, all of our participants know how the information is used, how the data is queried, so say if we go in and want to look at a particular area such as TAWS alerts, they know that we are querying their data for TAWS alerts.

Procedures and policies established through a collaborative governance, the procedures and operations that is established for ASIAS was done with all stakeholders involved and finally, all analyses are governed by an executive board that are made up of senior management from the FAA, other government agencies, and the operators, labor unions, and others. Next slide, please.

DR. BASEHORE: You can see, as of right now we have 22 partners and participants in the ASIAS program. All 22 of these operators make available ASAP reports, pilot ASAP reports, and 13 of these participants also have FOQA programs. These participants sign Memorandums of Understanding with the MITRE Corporation, particularly the Center for Advanced Aviation System Development, not with the FAA. The MITRE Corporation is a federally funded research and development center. The participants feel particularly comfortable with MITRE because MITRE, not being a federal agency, is therefore not subjectable to FOIA, so any information that is obtained by MITRE cannot by FOIA'd. I'd like to also add that the information, the data, itself, is not at the MITRE Corporation. The data remains on the airline premises or on the premises of the vendor that the airline uses to process their data. Right now we have approximately 5 million FOQA records that we can query and over 50,000 pilot ASAP reports that we can query. Next slide, please.

So this chart just demonstrates the coverage at certain selected airports so you can see, for example, in Atlanta the green shows that almost all operations at Atlanta Airport are covered either through a FOQA or an ASAP by the participating airlines. Some other airports have less coverage, such as Minneapolis, so we do know which airlines that aren't part of ASIAS that operate at Minneapolis and so we target them to become the next participants. This represents over 75 percent of all of the 2008 operations by 121 carriers in the United States. Next slide, please.

So there's four distinct types of studies that we conduct. The first is directed studies. Those are special topics that are put forth either by the Commercial Aviation Safety Team, the ASIAS executive board, itself, or any of our participants. We've conducted three to date, have two under way. Safety metrics are looking at known safety problems that have been identified in past accident investigations or through the Commercial Aviation Safety Team. We are able to monitor and put in place monitoring those particular known issues to make sure either that the safety enhancement that was generated to eliminate that particular issue is working or is seeing decreasing rates or conversely, if it's not, and we're either seeing no decline or actually increasing rates.

Benchmarking operations are the operators, themselves, are interested in knowing how they compare in certain instances against the rest of the industry. So we provide aggregate, which is the only type of information we can provide because it's all de-identified, so for example, if I can use again TAWS alerts, we provide the aggregate number of TAWS alerts on -- and we can do it monthly, quarterly, whatever, as seen across the NAS from our participating airlines, tell the individual airlines how we computed that.

That one's pretty easy, it's just we see the trigger in the FOQA data. And then they can compare their operations against the aggregate level. And finally, the really tough one that we're just getting started on, is the vulnerability discovery, what is occurring in the NAS right now that we haven't previously identified as a potential issue and how would we ascertain that, and so we would do that from -- atypicalities, abnormalities, and the like. And so we have in place research efforts to establish analytical methodologies to automatically discover those vulnerabilities. And as I said before, it's a collaborative effort and all efforts are overseen by the executive board. Next slide, please.

So I'm not going to go through all these, but what it essentially says it's we've got a lot of databases out there that we can draw from. Some are publicly available and you see from the lower left, either from the FAA, NASA, of course, the National Transportation Safety Board, we use a lot of the data from accident investigation. We have the de-identified FOQA and ASAP data from the airlines. We have ATC information. For example, we have the NOP, the National Offload Program, which provides us radar tracks. We're just now getting ASDX information as well.

And then we have the other information such as weather, winds, manufacturers data, avionics data, and the like. The issue that we have right now that we'll continue to work is that because we work with de-identified airline data, at this point we can't fuse all the information as we would like. For example, because it's de-identified we don't know the day of the week, the time of the day, so as of right now, we cannot merge that with the particular radar track data, the particular weather. We are doing some initial work with the FOQA vendors, where they are actually merging METAR data with the FOQA data before they de-identify it and we hope to be able to do that with other types of information and fuse that. And if I could have the last slide, please.

I just wanted to give a little demonstration of the power of being able to fuse the different data types. So this was a particular event that when we started looking across at TAWS events, the Terrain Awareness Warning System, we noted in both FOQA and ASAP that there are some particular areas in the country where we saw a significantly higher number of TAWS alerts than in others, so those are represented by the red dots and identified, as I said, by FOQA and ASAP.

So then we can combine that with the terrain data that we have from the National Elevation data and as you might suspect, it shows certain terrain areas that are the reason that we're seeing the TAWS alerts, then we can combine that further with the minimum vectoring altitudes that we receive from air traffic and these are generated to keep the aircraft away from these particular elevations.

We then can take another look and merge that one more time with the radar traffic tracks and you can see, actually in one area, the radar traffic tracks actually penetrate the minimum vectoring altitudes, so we're actually having aircraft penetrate through the MVAs and of course, that's going to generate a TAWS alert. And finally, we can then look at the airport and air space procedures that we're using and find that some of the approaches actually we put the airplanes fairly close to these minimum vectoring altitudes and that also can generate an alert. So by being able to fuse all of this data together, we get a more complete picture of what's actually happening. Then to take this one step further, as we complete this analysis, we hand it to the executive board who, in this case, because this was a commercial issue, then gave this back to the Commercial Aviation Safety Team who goes through and provides mitigations.

In this case, the mitigations were we actually came up with a new algorithm for computing minimum vectoring altitudes. We've come up with some new RNP approaches for this particular airport shown here, as well as making a recommendation that all operators update to the latest software in the TAWS box, which will eliminate a large percentage of these alerts. So with that, I'll answer any questions.

MR. BURTCH: Thank you, Mr. Basehore. Is this the closest to the system, APM, that ATR presented earlier in terms of programs of this nature? I know it doesn't actively provide feedback to the crew and you stated that earlier, but I was curious, is this the closest thing that the FAA is working on that would be comparable, that might expand into the area of active aircraft monitoring?

DR. BASEHORE: I can only speak to areas, you know, that I'm familiar with and having been in the R&D for aviation safety, I do know that we've been researching, particularly in the rotorcraft area, the HUMS, which are the Health and Usage Monitoring Systems, for the FAA. There may be other areas that are being investigated that I'm not aware of in the FAA.

MR. BURTCH: What would be the timetable for that technology that you do know of?

DR. BASEHORE: The HUMS system right now, I'm saying that that technology actually exists, and the issues are more with the certification and flight standards folks, so I can't address those issues. I do know for the types that such as the APM, there are other organizations out there that are actively pursuing those such as the NASA Aviation Safety program has one particular project known as the Integrated Vehicle Health Management System which is trying to look across not only safe propulsion systems, airframe structures, avionics and software systems, do diagnosis, monitor those systems, come up with the prognosis, any particular safety issues, and then either suggest or actually mitigate, but those are research programs and not actual programs that are being put in place today.

MR. BURTCH: What data are they based on, what operational data are they using to validate that technology?

DR. BASEHORE: So as presented with the APM, the majority of that data is actually available on the aircraft. There are some instances additional censors would have to be placed on the aircraft such as airframe structural monitoring, but then as I said, the majority of the information comes from the aircraft.

MR. BURTCH: How long has the FAA been working on this program or predecessor programs like VNA?

DR. BASEHORE: The program was actually originated at NASA in about 2004 at the request of the Commercial Aviation Safety Team who realized, at that time, that they had looked at a significant number of accidents and established the problems and precursors, and now we had to go to a prognostic. NASA started that in 2004, worked with four or five airlines. At that time the program was called VASIS. NASA discontinued their program at the end of fiscal 2007 at which time the FAA deemed it a very important program and took over. So we've actually been actively involved prior to ASIAS, but have taken over the program at the beginning of FY 2008.

MR. BURTCH: I have heard some metrics about the success of the ASIAS program. Can you share any of those?

DR. BASEHORE: Well, as I said, the TAWS example that I gave, we actually handed that over to CAST and CAST has established safety enhancements which were, I believe, approved during the last CAST meeting in August. We have been working with the airlines on an unstable approach metric similar to what was presented for APM except we select parameters that are not type or model specific, so we have nine parameters that we define thresholds for, for an unstable approach and can now look across the NAS and find out what percentage of approaches by the definition agreed to by the ASIAS participants are actually an unstable approach. Actually look at specific runways, we can down to the actual runway end and find out which areas are prone to unstable approaches.

MR. BURTCH: But more of a systemic problem?

DR. BASEHORE: Yes, we're looking across the system.

MR. BURTCH: That's all the questions we have.

CHAIRMAN HERSMAN: Does the Tech Panel have any other questions for any of the witnesses on the panel, any follow-up questions?

MR. BURTCH: I'm sorry. Madam Chairman, we have one more presentation from ATR, and it speaks to the accident, itself.

CHAIRMAN HERSMAN: Okay, all right. Then let's proceed with that.

MR. BURTCH: Mr. Caihol, if you want to --

MR. CAIHOL: I'm ready. The last presentation is related to the performance analysis we have run in ATR related to this Flight 8284. To run this performance analysis we have used the factual input such as the FDR data and the -- sheets provided by Empire and we have also used the -- data we have collected on this ATR 42-300 and it was built upon the flight test results we have run and conducted on the MSN 1 and 2. And the validity of this -- data have been verified on the MSN 175, the accident aircraft, the data we have collected during the delivery flight. And to do this, we have used this engineering software -- and this includes the -- license, the sixth degree of freedom software and also -- and control forces according to the control surface position. The first analysis covered the drag and the drag analysis has been conducted in three parts. The first part covered the first icing encounter at flight level 180 and up to 14,000 feet.

And we have compared the actual drag during these flight phases with the certificated -- that are applicable for the clean aircraft or polluted aircraft, so you will see this word several time and by polluted aircraft, we mean -- shapes on unprotected -- edges and inter-cycle ice shapes on the boots. So this is again the first icing encounter and it showed the drag -- as a function of the lift here. There are three curves on this slide.

The black curve is related to the certification pull-off or clean aircraft. And the dot curve black is related to the polluted aircraft and the red curve respond to the Flight 8284 during this period. What we can see that flight level, the drag of the 8284 stayed within the certification envelope of the clean aircraft and the polluted aircraft. The drag analysis also show that when the aircraft crossed the altitude of 10,000 feet where the static temperature was above freezing, the drag of the aircraft was nominal. I mean, it was a clean aircraft configuration. Second icing encounter was at flight at altitude of 5,000 feet, roughly. And again, we can see that the aircraft to drag of the Flight 8284 stayed within the certificated envelope. So the next step of the drag analysis was run with our 6 DOF model. This is to take into account the different aircraft configuration where one flap was extended partially while the other one was staying at zero degree, and we have used the FDR parameters and again compare the drag of the aircraft with the certification drag -- so here we have different curves than previous one.

This is because in this conditions for the red curve, we have additional drag devices on that aircraft because we have a flap that were extended partially and the gear were extended while this drag is compared with the certification -- for flap zero with the gear retracted. And we are, even with additional drag devices, we are still within the certification envelope.

So now some numbers to give an idea of what was the level of the drag during the first icing encounter. The drag had been increased by 18 drag counts while during the second icing encounter the drag was estimated to be 130 drag counts and this drag level correspond to roughly 10 to 25 percent of the available power, so there was a lot of power still available to maintain the correct speed. Next step of the performance analysis address the lift. So there are a lot of information on this curve. The red curve of the clean aircraft, non-polluted at flap zero, and this is the certification that is coming from -- and the blue curve is also for the clean aircraft with the flap 15 configuration. And the aircraft or the Flight 8284, the point of -- the black triangle correspond to the condition of the aircraft before the flap extension, before the flap anomaly, and the orange triangle correspond to the portion of the flight after the flap anomaly. And we can see that even if there were icing condition and that was probably the aircraft was polluted, the lift stayed within the certification curve of the lift for clean aircraft and this up to the stall warning and even above the stall warning.

So here we are comparing the same actual lift of that aircraft with the lift curve for polluted aircraft and here we can see that we still have a lot of -- and this even beyond the stall warning threshold. So the conclusion for the lift analysis, that we were in icing condition or the aircraft was in icing condition, there are probably some loss of lift, but then this loss of lift was within the certification envelope and this even above the stall warning threshold.

And this is the final conclusion for the performance analysis in term of drag and the lift of Flight 8284, stayed within the certification envelope for the drag and the lift. We also conducted controlled forces analysis and this was done according to the instruments and the FDR -- that gave us the control surface position. And we have computed the controlled forces on the three axes, on the roll, on the yaw, and on the pitch, and this is a curve that show the control forces for the wheel and the -- during the final approach. On this graph there are four different periods. The first period is when the autopilot is activated and engaged and control the aircraft directly, after the flap asymmetry. And what we can see that the control forces are close to zero for the wheel and the only -- or deviation to the zero is when the aircraft -- was changing and the -- forces correspond to autopilot input to keep -- after the flap asymmetry there is a step on the -- forces just below 10 pounds, so this correspond roughly to 20 pounds, and this is handled by the autopilot. This is the second period.

The third period is after the pilot disconnection while the first officer was flying the aircraft, so we stay still within the same magnitude of forces on the wheel. And the last period is when the captain took the control, where the behavior or the duration of the control forces are different, so it's different techniques to fly the aircraft, and it is during that last period where the maximum -- forces were recorded on the wheel and on the -- directly linked to pilot inputs, and they have been compute to be -- down on the wheel and -- down on the pedal.

And we have run similar computation on the stick forces where again we can see the four different period -- and again, the maximum forces on the stick was recorded when the captain was in control of the aircraft. And the final conclusion of all performance analysis, that during this flight the aircraft encounter icing condition, but the effect on the aircraft of this condition in term of performance including drag, lift, control forces, and instrument were inside the certification envelope.

MR. BURTCH: Thank you. To speak to those slides you showed about the control forces, pilot control forces, did your analysis show three distinct regimes, basically, the first being where the autopilot was flying the airplane, the second where the first officer was flying the airplane, and then the third, where the captain was flying the airplane?

MR. CAIHOL: Yes.

MR. BURTCH: I want to make clear, before the autopilot disengagement, while the plot showed a pilot force, that was actually carried by the autopilot; is that correct?

MR. CAIHOL: Yes.

MR. BURTCH: The three inch and inter-cycle ice shape, where did that come from?

MR. CAIHOL: It's coming from the analysis and the computation and the ice shapes we have computed in Appendix C condition, and are the kind of ice shapes you may collect on the aircraft surfaces while holding for 45 minutes in icing condition as defined by the Appendix C. And the -- shapes, the kind of ice shapes that will accrete on the leading edges that are not protected and inter-cycle ice shapes, the ice you will collect between activation, two consecutive activation, of the icing boots.

MR. BURTCH: Do you feel your analysis was consistent with the weather reports you saw yesterday?

MR. CAIHOL: Yes. Yes, this also consistent with the pilot testimony that was aware he was flying in icing condition at flight level 180, and also aware -- activated in the second icing encounter.

MR. BURTCH: And nothing at 14,000?

MR. CAIHOL: Sorry?

MR. BURTCH: And there was no icing at 14,000, I think that was also consistent with what we heard yesterday.

MR. CAIHOL: I cannot tell what kind of icing condition they encounter, but the icing condition they have encounter are the one proved or include in -- of the aircraft similar to the one we have in Appendix C.

MR. BURTCH: Did the five stick shaker events correspond with what ATR would've predicted?

MR. CAIHOL: Yes.

MR. BURTCH: On Page 9 you had, you indicated a significant loss of lift. It was a distinct break in that curve. Could you say again what that was? Page 9.

MR. CAIHOL: So the Page 9 is referring to the drag. There is no mention of lift.

MR. BURTCH: Okay. Yeah, there was a break in the drag on Page 9. Very distinctive.

MR. CAIHOL: Yes.

MR. BURTCH: I just wanted to clarify what is your thought on that break in the drag pull?

MR. CAIHOL: So this break occur with the simulated ice shapes and when flight test with these simulated ice shapes, and the break is beginning at the stall warning threshold and we have beginning to entering in some minor -- we are in the buffeting area and we are approaching to the stall.

MR. BURTCH: So you're getting into that nonlinear area around the stall?

MR. CAIHOL: Yeah. So we go to the stall warning. We haven't measured the computer simulator on the Flight 8284, it's only with the simulated ice shapes.

MR. BURTCH: Thank you. Your earlier presentation on the ice protection system mentioned an instability in roll as a cue, ice cue. Did you see or observe anything in the data for this accident?

MR. CAIHOL: No.

DR. BOWER: I just have a couple questions. Going back to the shapes that were used for comparison in terms of the three-inch and inter-cycle ice, just out of curiosity, the inter-cycle ice shape that was used for comparison, as part of the comparison, can you comment on the extent of coverage that inter-cycle ice shape, its properties and anything to -- any comment on its texture?

MR. CAIHOL: Yes, as far as I remember, this ice shape, we have introduced on it some roughness and the thickness was about 4 or 5 millimeter and included some -- aspects, some roughness, just to simulate the roughness we may encounter with -- icing or inter-cycle icing.

DR. BOWER: In the terms of how far it covered the boot, did it cover the entire boot surface or just along the leading edge?

MR. CAIHOL: It was covering the usual ice accretion coverage while encountering Appendix C icing condition. I mean, droplets diameter in the range of the Appendix C icing condition.

DR. BOWER: And those values obtained for comparison were obtained via flight test?

MR. CAIHOL: Yes, of course. After having performed the flight test in dry air condition with the simulate ice shapes, we validated the results with natural icing encounter, and we have checked the effect on the aircraft in natural icing condition where the one we run with simulated ice shapes -- compared with the natural icing encounter.

DR. BOWER: And the two charts you showed, one at the

4800 feet MSL and then the other one during the final approach, we see increase in drag, however you said the second one also included the flap asymmetry. Did you have an idea of about how much of that was increase in drag was due to ice and how much due to the flap effect?

MR. CAIHOL: To the flap effect is very few, is very minor, so the flap induce little increase in the drag. Most of the drag is -- and even the gear does not introduce lot of drag. Most of the drag is only due to icing.

DR. BOWER: That increase in drag, would that indicate a worsening situation in terms of the effect on the performance of the airplane?

MR. CAIHOL: I do not know if it is worsening condition. I only know that at this time the angle of attack was higher and that -- also increases drag, so we have larger drag, of course, during the icing encounter but stay within the certification --

DR. BOWER: And you also mentioned that no loss of lift was obtained until the higher angle of attack occurred during the flight near 8 degrees and 12 degrees on the vane.

MR. CAIHOL: Yeah.

DR. BOWER: And that was very close to the ground, the -- of the flight, but that motion in those few seconds, is that about what you would expect of an airplane at that angle of attack?

MR. CAIHOL: Yes.

DR. BOWER: Okay. I have nothing else.

MR. BURTCH: That ends the questions, honest.

CHAIRMAN HERSMAN: Okay, great. Empire.

MR. MILLS: Thank you, Madam Chairman. We have no questions.

CHAIRMAN HERSMAN: FAA.

MR. HARRIS: Thank you, Madam Chairman. We do have some questions.

Mr. Stimpson, you mentioned the FAR 25, about 699 Alpha issue related to flap indication for asymmetry, that one of the presumptions was or assumptions was that the crew was complying with the aircraft flight manual procedure, and I believe you also mentioned including the indicated air speed; is that correct?

MR. STIMPSON: That's correct.

MR. HARRIS: Have you reviewed any of the flight data recorder information in the last few minutes of the flight relative to air speed indication?

MR. STIMPSON: I've seen the air speed traces from the accident flight, yes.

MR. HARRIS: Could you identify the lower end of the air speed range that you saw during that event?

MR. STIMPSON: It was in the area of 125 knots.

MR. HARRIS: I think earlier there was some testimony that the computed -- for zero degrees flaps icing conditions for this aircraft as a result of the QRH procedure for, I think it's jammed, uncoupled, or asymmetric flaps was 143. As an expert on performance and handling in fixed wing aircraft, could you give us some indication or comment of how the aircraft might handle or perform if flown at 125 knots versus 143 in general, on the basis of your knowledge of transport airplane performance handling?

MR. STIMPSON: I'm glad you added the caveat in general. It's hard to comment specifically on what may happen in --

MR. HARRIS: And I'm certainly not asking you to do that.

MR. STIMPSON: All right. In general, I would expect degradation in handling qualities and performance. To that degree of speed reduction, I would expect for there, depending on how those minimum speeds were produced and this was a minimum speed for icing conditions with that flap configuration, I would certainly expect the airplane to be around the area of stall warning and potentially, actually with that much speed reduction, it's probably very close to its 1G stall speed which, if the airplane is maneuvering at all, it's going to be close to a stalling condition. There should be adequate handling capability down to the stall, but I would expect it to be a degraded capability.

MR. HARRIS: Thank you very much.

Mr. Caihol, in the QRH for Empire Airlines, which I believe is taken substantially from the airplane flight manual for the ATR 42, there's a procedure labeled Flaps Jam Uncoupled Asymmetry. Are you familiar with the grouping of those malfunctions together under one umbrella of potentially the flaps failing to move to a commanded position?

MR. CAIHOL: Yeah, the only common entry point indication we have on the indicator, so the indicator show that the flap did not move to the desired position and whatever the kind of -- if it's a jam for the four flaps or jam of one flap, the procedure is the same.

MR. HARRIS: So in terms of the level of diagnosis required by a pilot in that event, the procedure provides for essentially a family of events that have a symptom which is that the flaps didn't go to the commanded position, the actual diagnosis of the cause of that failure is of no consequence to determining the pilot action to make, correct?

MR. CAIHOL: It doesn't matter. If the pilot at the time conducted a deeper trouble shooting, but he doesn't need to conduct this trouble shooting.

MR. HARRIS: Thank you very much. Sir, just to understand your testimony relative to the performance of the aircraft, am I to understand that the aircraft, even though it was operating in freezing drizzle and even though it had a flap asymmetry, it remained within its operating envelope of performance and handling?

MR. CAIHOL: I do not know if the flight was conducted in freezing drizzle. The only thing I know that the performance degradation was the one expected in Appendix C icing condition.

MR. HARRIS: Thank you very much. Are there any specific prohibitions or limitations in the ATR 42 airplane flight manual which directed an operator not to dispatch or operate in freezing drizzle?

MR. CAIHOL: The flight manual is written for the flight crew and there is a limitation section that explain the flight crew that the SLD condition and freezing drizzle and freezing rain may -- are condition considered conducive to severe icing and clearly state that if this condition identified by the flight crew, they have to apply the emergency procedure and exit this conditions. So for a pilot to -- if he is identifying that he is in this condition, he cannot fly. Or if he's already within, he'd have to leave.

MR. HARRIS: And the indications for a severe icing encounter are contained also in the airplane flight manual having to do with the side window icing of a substantial portion of the unheated side window and possibly the loss of performance on the aircraft, and then some additional secondary indications, correct?

MR. CAIHOL: Yeah, they are defined in the limitations section and this includes the side windows, the unusual ice accretion extent on the -- that could be -- by the flight crew, the spinner and the -- and also other visual cues such as droplets splashing on the windows, so precipitation a temperature close to zero degrees Celsius.

MR. HARRIS: Thank you. And those cues are available with or without the ice evidence probe or with the APM; is that correct?

MR. CAIHOL: Yes.

MR. HARRIS: Thank you. Are there any limitations to the application of ground deicing holdover times in the airplane flight manual related to freezing drizzle or freezing rain?

MR. CAIHOL: I do not know if it is within the flight manual. Ground deicing is the icing procedure you are applying on the aircraft to be sure that the aircraft will be clean when you take off, so the only limitation we have in the flight manual is stating that you are to take off with a clean aircraft. And the ground deicing procedures are the procedure established by the flight to begin and to ensure that the aircraft is clear of ice before taking off.

MR. HARRIS: Does ATR have a policy or a statement relative to the use of holdover times in freezing drizzle?

MR. CAIHOL: Yes. This policy is the one published by -- Air Transport Canada, and so it's a commonly used procedure. And the -- guidance material that allow the flight crew to estimate how long the aircraft will be protected to the deicing -- that have been used, the temperature, the dilution, and the kind of precipitation outside. And this precipitation would be freezing drizzle, snow, freezing drizzle and freezing rain, and that could be in some guidance more detailed -- and precipitation such as light freezing drizzle or freezing rain, but it's only addressing ground icing condition and how to estimate the holdover time provided by the deicing, anti-icing procedure before performing takeoff.

MR. HARRIS: Thank you, sir. The reason I'm asking the question is for clarification because it appears there's -- in Exhibit 2TT, a letter from ATR to Transport Canada, I believe, there's a discussion that the holdover times for freezing drizzle should not be applied. Could you comment on that so we can understand it?

MR. CAIHOL: Yes. In fact, the ground deicing procedure is completely different from the one we are applying in flight, so ground deicing procedure is only the process to get the aircraft clean prior to takeoff, but you cannot take into consideration extra time -- while you are flying, so it's only addressing the status of the aircraft on ground and not in flight. So you cannot take any credit for any protection when the flight has begun and when you are taking off.

MR. HARRIS: So then the letter speaks to not taking credit for the deicing fluid once the aircraft lifts off?

MR. CAIHOL: Yes.

MR. HARRIS: Thank you. That does clarify that tremendously, sir. You mentioned that the APM system is not required. Are you aware of any future requirement for the APM?

MR. CAIHOL: Yeah, as I said during my presentation, there are regulatory activities in that direction to ask the aircraft manufacturer to install devices to tell the crew when to exit icing condition that exceed the aircraft capability and I think the -- the APM is probably the most appropriate to -- this kind of -- such a requirement.

MR. HARRIS: But specifically you're not aware of any future regulatory requirement by a certification agency for the requirement for APM, is that --

MR. CAIHOL: No.

MR. HARRIS: I see. Are there any current data bus limits on the ATR 42 series aircraft that would require something other than -- forgive me for being so blasé about it, but the simple implementation or installation of the multifunction computer in APM, would there be a data bus revision for the aircraft also required?

MR. CAIHOL: Sorry, could you resubmit your question?

MR. HARRIS: Yes, sir, I will. Are there any data bus limits on the current ATR 42 fleet that would require replacement of the data bus or revision of the data bus in order to install the multifunction computer in the APM system today?

MR. CAIHOL: I do not understand, what is behind the database?

MR. HARRIS: I'm talking about the --

MR. CAIHOL: Data bus?

MR. HARRIS: -- data bus, sir, the data communication system onboard the aircraft.

MR. CAIHOL: I'm not sure there is any link with the data bus.

MR. HARRIS: Thank you very much. I appreciate your assistance and your ability to speak in many languages. I think I would be very much at a disadvantage if I were to face a group of people speaking in French, and I appreciate your ability, sir. Thank you.

MR. CAIHOL: Thank you, sir.

CHAIRMAN HERSMAN: ATR.

MR. FLANIGIN: Just one question, Mr. Caihol. Could you tell us the approximate total time of the ATR fleet worldwide, ATR 42 fleet?

MR. CAIHOL: The ATR 42 fleet, including ATR 42 basic and ATR 42-500 are flown roughly 12 millions cycle.

MR. FLANIGIN: Thank you.

CHAIRMAN HERSMAN: Thank you. Mr. Haueter.

MR. HAUETER: Thank you. Just a couple of questions. Mr. Stimpson, regarding icing conditions, is SLD considered in the Appendix C icing conditions?

MR. STIMPSON: I think that question's probably better directed to the last panel, but my understanding is that yes, there are some freezing drizzle conditions that can be considered to be within the Appendix C envelope.

MR. HAUETER: My question goes back that we hear from a lot of pilots, in fact we heard from the FAA witnesses yesterday that the airplane was approved for all known icing conditions, yet there appears to be a known icing condition that it may not be good to operate in.

MR. STIMPSON: The Appendix C envelopes are an engineering design standard for the design of the ice protection system. It's an attempt to distill a complex atmospheric phenomena down into some simple parameters that can be measured and can be used in analysis to determine, for instance, ice shapes that would occur on an airplane in that environment for a given period of time. The parameters involved are things like the mean effective drop diameter, which when you're talking about a mean you can have different distributions of those drop diameters.

You're not going to have one drop diameter in a cloud. Liquid water content and the vertical and horizontal extent of those clouds that have the super-cooled vapor in them that cause icing. There is an altitude extent to the environment, to the envelope, and also a temperature extent. They were acknowledged at the time that they were produced that they represent approximately 99 percent of all icing encounters. It's going to be difficult in any case to divine an environmental condition that's going to cover you 100 percent in this complex environment.

Most of the freezing -- all of the freezing rain and most of the freezing drizzle are outside that environment, but there are also conditions that are not large drop conditions that are not covered within that environment. Ninety-nine percent is the estimated coverage of that envelope and that is in terms of all icing conditions that may be encountered.

MR. HAUETER: Okay, thank you.

Mr. Caihol, regarding your performance monitoring system, could that be installed by an operator or does that have to done at the factory?

MR. CAIHOL: Sorry, I did not catch your question.

MR. HAUETER: Your performance monitoring system that you mentioned, could that system now be installed, retrofitted by an operator at his facility, or would it have to go back to the factory for installation?

MR. CAIHOL: No, no. He can install it by himself. If he has a large fleet, we could provide some assistance, but it is possible by any operator's maintenance station.

MR. HAUETER: Okay. And then you also mentioned with the system that if it passes the check, even though you're in icing conditions, it's okay to reengage the autopilot?

MR. CAIHOL: Yes.

MR. HAUETER: Do you see any benefit to the pilot still staying engaged in icing conditions and flying the aircraft to see if there are any changes going on or --

MR. CAIHOL: Yes, it is already mentioned in our flight manual that when they're flying for a while in icing condition, they may engage the autopilot to sense for any -- while in icing. But it's better to reengage the autopilot.

MR. HAUETER: It's better to reengage the autopilot?

MR. CAIHOL: Yes, for long seconds, better, I think -- I am not the pilot, but is more comfortable to have the autopilot engaged.

MR. HAUETER: Okay. That seems a bit of dichotomy that if you're in icing conditions, you think you'd want to feel if there are any changes going on in the performance of the aircraft at the same time you're recommending to engage the autopilot.

MR. CAIHOL: If there is no effect of the icing condition on the -- itself, you can reengage it. There is no limitation.

MR. HAUETER: Okay. And my last question to you is given that there's different types of icing conditions of SLD versus other cool droplets, how easily can a pilot tell which one he's in, one that's within the certification envelope and then a condition that's outside?

MR. CAIHOL: There is no devices measuring the droplet diameter, but water contain the range of diameter, so this may lead to very complicated aircraft -- the only cues provided to the flight crew is the kind of degradation it would encounter while in icing condition and the aircraft provides cues and indication when it is exiting the condition for which it had been certificated.

MR. HAUETER: Okay. And then finally, Mr. Basehore, regarding ASIAS, is MITRE randomly handling the data for what-ifs or other possibilities?

DR. BASEHORE: No, not randomly monitoring. We are attempting to put in place analytical methodologies looking for atypicalities, exceedances, along those lines but no, not -- that's not permitted under the procedures and operations document.

MR. HAUETER: Do the MITRE folks, if they see events happening in industry, can they voluntarily go into the data and start examining that to provide the information to your executive committee?

DR. BASEHORE: If they see events while doing investigation on an approved study by the ASIAS executive board and it's related to that study, yes, they can certainly -- it's called a thread analysis. They can go back and continue to investigate that particular issue.

MR. HAUETER: So all of their analyses have to be approved beforehand by the executive board?

DR. BASEHORE: Yes, except as I just mentioned. If they -- during a directed study or a safety metric they notice something that's contributing -- it might be another issue -- they are permitted to do that -- we call it a thread analysis -- and see where that leads.

MR. HAUETER: Okay. Thank you very much.

CHAIRMAN HERSMAN: Dr. Kolly. And for those of you all on the witness panel, if you just keep one mike live, we won't get feedback.

DR. KOLLY: Mr. Caihol, yesterday we heard the captain state that he was trying to do everything he could to assess the situation of the flap anomaly. I'd like to clarify this with some of the information that you provided here today. Is an asymmetric flap configuration visible from the cockpit?

MR. CAIHOL: Yes, it's visible. I've shown in two presentation that there were for night operation wind detection lights, that low vision of the flap -- indication. So they are available even for night operation.

DR. KOLLY: What types of diagnosis or trouble shooting is possible in that situation? He stated, for instance, that he was checking circuit breakers. Is that something that's reasonable?

MR. CAIHOL: I cannot state it on that. It is not required to perform the trouble shooting. The indicator provide indication that the flap had jammed in the position between zero and 15 degrees, and this is sufficient to allow the flight crew to enter into -- and apply the -- flap landing procedure. There is no -- for trouble shooting if he has time he can perform it from his own knowledge, but there is no additional procedure he will apply according to the kind of -- he can do.

DR. KOLLY: Thank you. Mr. Basehore, I have just one question. When an analysis is performed and a finding is reached by the MITRE analysis team and that is reported back to -- I believe it's reported back to the executive committee; is that correct?

DR. BASEHORE: That's correct.

DR. KOLLY: How does that information, then, get out to the aviation community? Is it shared beyond those folks that are -- beyond those groups that are participating in the program?

DR. BASEHORE: There are two ways that it's shared. First, the determination is made which organization could work through the mitigations and for example, if it's sent to the Commercial Aviation Safety Team, then the mitigations that are determined are, of course, extended to the entire aviation industry. The initial results prior to a mitigation are shared with the ASIAS stakeholders because they, in fact, are the organizations that have contributed the data.

DR. KOLLY: And you say it's initially shared with the stakeholders. Do they have some type of authority or any type of ability to withhold that information or send it back for further analysis? Once the analysis is made, is there anything that they can do to influence that analysis or is the analysis done just to --

DR. BASEHORE: I didn't want to give the vision that MITRE's the only folks that participate in the analysis. When we do an analysis, we also, in our working groups, have subject matter experts that represent the operators, the labor unions, the manufacturers, so on. When MITRE conducts an analysis, it's just not MITRE analysts; it's analysts from all of the participating stakeholders.

DR. KOLLY: All right, thank you. No further questions.

CHAIRMAN HERSMAN: I recognize we're right on the edge of our lunch break, so I'll try to limit my questions. I understand that the aircraft met certification standards, but was this flight, the weather that they encountered on this flight, was that contained within Appendix C certification standards or was it outside of --

MR. CAIHOL: I do not know. The only statement I could do that the effect of the icing condition they have encounter were within the certification envelope, so it could be Appendix C condition for a while or the beginning of severe icing without -- associated to short exposure, but there were icing condition and the effect on the aircraft were within the certification envelope.

CHAIRMAN HERSMAN: Mr. Stimpson, do you want comment on that?

MR. STIMPSON: I'd like to echo that answer. I think the only way you would know is if you had -- it takes special instrumentation on the test aircraft, themselves, when we do our naturalizing tests to determine where in the envelope that icing condition is and it would've taken the same thing on this airplane. What we have heard, I think, from the testimony of the crew is that severe icing cues were not present and the effect on the airplane is such that it was within the effects expected of an Appendix C icing encounter.

CHAIRMAN HERSMAN: But isn't that -- doesn't that kind of really encapsulate the challenge here because they aren't in severe icing conditions that they would expect to see as far as accumulation and things like that, they're not getting three inches of ice. We can identify that they were in reported freezing drizzle conditions and so maybe the commensurate performance of the aircraft is not consistent with what their expectation would be given the environment.

MR. STIMPSON: Whether or not they were within actual reported drizzle at any point in that flight path, though, if they were in freezing drizzle conditions it did not result in severe icing that the airplane was not able to handle. The airplane behaved as if it were in a normal Appendix C icing encounter.

CHAIRMAN HERSMAN: When you say normal, isn't it at the top of that?

MR. STIMPSON: It's within the Appendix C.

CHAIRMAN HERSMAN: Okay.

MR. STIMPSON: It's within the -- what was used as ice accretions on the airplane during the certification which is conduced within the Appendix C icing envelope.

CHAIRMAN HERSMAN: Okay. We talked about the issue of exceptional piloting skills not being required. I think one of the challenges I have is when we're doing flight testing, maybe you can help me with this, aren't the test pilots briefed ahead of time about what they're going to be doing? They're not surprised, right, when they encounter a certain condition when they're in test?

MR. STIMPSON: Want me to --

CHAIRMAN HERSMAN: Sure.

MR. STIMPSON: I'm not the -- I don't conduct flight test, I'm not a flight test engineer or a flight test pilot, but in general, if they're doing icing tests, yes, they know that either they've got the ice shapes on the airplane or they're going to be flying into icing conditions but it is certainly the responsibility and job of an FAA or a regulatory agency flight test pilot to be able to assess whether it takes exceptional piloting skill or strength to conduct the maneuvers that they're doing. That is within their job responsibility to act as the average pilot.

CHAIRMAN HERSMAN: Okay. And so do they have to build in a delay for response because they are kind of -- they don't need to diagnose the problem but an average pilot would probably need to diagnose it because they're not really prepped for the test flight?

MR. STIMPSON: Yes, we do build delays into our guidance on how to conduct given tests, especially in terms of different malfunctions and things. There is a time to detect the malfunction or the situation, there's a recognition time, and then there's a time to -- a reaction time beyond that.

CHAIRMAN HERSMAN: And I would say if pilots are a bell curve of our test pilots, hopefully, are kind of the best of the best and I think my concern is if we're kind of writing kind of some of this for the average pilot then there's potentially also some pilots at the other end of that bell curve that aren't necessarily average, and so kind of that's one the kind of challenges I see. I certainly would love to have, as a pilot, on any flight that I'm on, the test pilot, but I don't get to pick that and so what I want is the pilot, you know, who maybe needs more time to identify or diagnose the problem, to have the time to do that. So is there a standard, you know, when you're saying there's a delay built in? It sounded like in response to the questions of the Tech Panel you were kind of saying that's operator by operator, they determine how to do their test flights.

MR. STIMPSON: You mean manufacturer by manufacturer?

CHAIRMAN HERSMAN: I'm sorry, I'm sorry. Right, manufacture.

MR. STIMPSON: No, we actually participate in -- the regulatory agency involved participates in those test flights and there is guidance on how to, in different situations, depending on where the failure in the phase of flight is, there are specific criteria for the delays that are associated and you will see them count one-thousand-one, one-thousand-two, one-thousand-three before they can act on the controls.

CHAIRMAN HERSMAN: Okay. And the test pilots, when they're dealing with a situation, do they actually have multiple emergencies or maybe multiple failures at the same time or when they're testing for this particular scenario, are they testing for only that? Like, for example, if you're looking at icing and certification for within the envelope, would you also layer on and -- you know, a mis-termed aircraft or an aileron problem like they had here or were you only looking at one thing at a time?

MR. STIMPSON: In general, it really depends on the specific failure condition, as well as icing. There are situations where definitely you apply a failure condition that would occur in a given atmospheric condition such as icing or such as crosswinds or such as turbulence, but it really depends on the failure condition you're looking at and the weather situation that you're looking at as well. There is a combination there.

CHAIRMAN HERSMAN: Okay. So it seemed to resolve this aileron asymmetry. They need to trim it out, is that correct, in order to kind of continue to be able to fly the aircraft it has to trimmed out? And maybe Mr. Caihol can answer this.

MR. CAIHOL: Yes, just to correct that it wasn't an aileron asymmetry, it was a flap asymmetry.

CHAIRMAN HERSMAN: I'm sorry, a flap asymmetry.

MR. CAIHOL: And this induce a rolling moment as explained in my presentation and the autopilot controlled the rolling moments for aileron inputs. And so we have seen that the induce forces was -- turn down on the wheel and as explained yesterday during the testimony of the pilot, it is distinctive to trim the aircraft when you have excessive -- or an increase in loads.

CHAIRMAN HERSMAN: But from what I understand is the recorder doesn't record the trim, if it was inputted in.

MR. CAIHOL: Yeah, the trim is not recorded. We have determined that the aircraft or the aileron were not trimmed upon the autopilot disconnection.

CHAIRMAN HERSMAN: Okay.

MR. BURTCH: Excuse me, Madam Chairman, just to clarify. We do have elevator trim recorded on the FDR. There was no elevator trim inputs after the auto-trim function of the autopilot disengaged so after it disengaged, we didn't see any elevator trim input. Rudder trim and aileron trim are not recorded.

CHAIRMAN HERSMAN: All right. Is it more likely to get asymmetry in icing conditions?

MR. CAIHOL: No.

CHAIRMAN HERSMAN: No. And what, specifically, could cause an asymmetry?

MR. CAIHOL: The level of detection is slow and the actuator are very -- any delay in extension on one side may lead to an asymmetry, so if there is something that prevent the extension to initiate, the flap on the other side will begin to extend maybe faster and this will lead to an asymmetry, so any malfunction or some malfunction of the actuator on the one side -- direct contamination on the return line may lead to an asymmetry.

CHAIRMAN HERSMAN: And could ice cause that or cold weather?

MR. CAIHOL: Cold weather, we'd have to determine the water state between the flap and the fixed part of the wing and freeze. This is not -- have never been reported.

CHAIRMAN HERSMAN: Okay. The circumstances of the 2002 TransAsia Airways ATR event, did that -- that aircraft did have an IAP. Did they have an APM?

MR. CAIHOL: No.

CHAIRMAN HERSMAN: Okay. And in that one, you all determined with the authorities in Taiwan that the drag increased by 500 counts and that translated to a decrease or a degradation of 40 knots in speed. What did you determine in this performance study? What was the speed loss or the degradation in speed?

MR. CAIHOL: On which flight?

CHAIRMAN HERSMAN: On this accident flight.

MR. CAIHOL: The maximum drag count, we have measured this, 130 drag count during the second icing encounter in the final approach, and the speed decrease, we have recorded this not due to the drag increase, to pilot input that -- so there is no speed reduction due to icing. We had the drag increase, that is one-third of the one we have experience in -- accident.

CHAIRMAN HERSMAN: And is there a low speed indicator aside from the APM system on this aircraft?

MR. CAIHOL: There is no low speed indicator. There is only the indication on the fast and slow indication if you are set the target value for your speed.

CHAIRMAN HERSMAN: All right. And on the IAP distribution, can you just explain to me, I think you said you provided the equipment to all operators that have this aircraft; is that correct?

MR. CAIHOL: Yes. In 1987 or '89 or '88, I do not remember exactly, we -- as we determined that the IAP was very -- to appreciate the intensity of the ice accretion and to determine when the aircraft was entering in ice accretion condition. We have distributed this kit free of charge to all operators.

CHAIRMAN HERSMAN: How much does it cost to install?

MR. CAIHOL: I do not know the cost to install. I even do not know the cost of the kit. The installation is usually performed by the operator, so I do not know their own cost.

CHAIRMAN HERSMAN: Is it significant? I mean, we're talking about putting something on the outside of the aircraft, kind of bolting it in or screwing it on?

MR. CAIHOL: According to the service bulletin, the time required to install this device is half a day.

CHAIRMAN HERSMAN: Half a day. So if you put out a service bulletin and you provide the equipment free of charge and the operators don't do it, what would you need to make the operators do it, an AD?

MR. CAIHOL: We only need to know if the operator has installed the devices, so when we provide -- there is specific pages in the service bulletin, the operator shall return -- to know if they have installed the kit or not. The only way to get mandatory installation is an AD, of course.

CHAIRMAN HERSMAN: Okay. And in your explanation of the APM, you explained that there were two alerts that would've gone off for this aircraft, one 70 seconds before, one 40 seconds before, but I think in your presentation you also mentioned that once the flaps and the landing gear are extended, there are no more warnings; is that correct?

MR. CAIHOL: Yes.

CHAIRMAN HERSMAN: Can you explain to me the logic behind that?

MR. CAIHOL: The logic that the APM is sensitive to transient condition, to transient flap condition, for example, and so we omitted the APM operation to the portion of the flight where we tend to avoid the -- warning, or unwanted alert.

CHAIRMAN HERSMAN: And how many ATR 42/72s are out there in the fleet worldwide?

MR. CAIHOL: There are less than 800 -- flying.

CHAIRMAN HERSMAN: And how many -- what percentage have installed the APM system?

MR. CAIHOL: 250 aircraft that are equipped.

CHAIRMAN HERSMAN: Okay, thank you.

Mr. Basehore, does Empire have an ASAP/FOQA program, do they participate? I didn't see them on the list.

DR. BASEHORE: No, Empire does not have FAA-approved ASAP or FOQA programs, although yesterday they did mention that they were in the process of introducing ASAP and FOQA programs.

CHAIRMAN HERSMAN: How about FedEx?

DR. BASEHORE: FedEx has a FOQA and ASAP program. They are not currently ASIAS participants.

CHAIRMAN HERSMAN: Why not?

DR. BASEHORE: My understanding that there are some difficulties with the -- at the local level with the union representation.

CHAIRMAN HERSMAN: Okay. And you talked about using weather information and other data with FOQA information before de-identifying it, so in the future would we have the potential to see aircraft that enter weather conditions that might be outside of Appendix C and experience a performance degradation, is that something potentially we could mine the data for?

DR. BASEHORE: Yes. For example, if there was a segment issued and if we could merge that information with the FOQA data or the radar track data for a given aircraft prior to de-identification, yes, that would be possible.

CHAIRMAN HERSMAN: And when you de-identify things, would you leave in, clearly leave in aircraft type -- would you leave in the operator?

DR. BASEHORE: No. We get aggregate information back from a query, so it's just all the information -- it doesn't identify individual operators.

CHAIRMAN HERSMAN: So if one operator has procedures that keep it out of trouble and another operator doesn't, we're not really going to be able to tell through this data?

DR. BASEHORE: Through the aggregated data, no, you can't identify. Let me say, there are times when you could identify an individual operator, but the procedures and operating rules that are in place now would be that ASIAS would have to go back and speak directly with that particular operator and notify them, that they were identified through the analysis.

CHAIRMAN HERSMAN: Okay. And it sounded like the way that you get your queries or your projects are through a board of some sort?

DR. BASEHORE: Yes, we get them through the ASIAS executive board.

CHAIRMAN HERSMAN: And I'm interested if there's a way for the NTSB to be able to tap into some of that data in the future, you know?

DR. BASEHORE: I believe that my immediate supervisor and the director of my office have been in contact and have been discussing this with several of the Board members.

CHAIRMAN HERSMAN: Okay. Okay, good. And Ms. Violette, could you show Page 8 of Mr. Caihol's aircraft performance presentation? It was up just a little while ago. Were they in Level 3 ice detection when flaps were selected? Mr. Caihol, do you remember? Were they in Level 3 ice detection when flaps were selected?

MR. CAIHOL: All the level of ice protection system were activated.

CHAIRMAN HERSMAN: But they continued to accumulate ice, resulting in the 120 count drag?

MR. CAIHOL: They are accumulating ice on the unprotected rears and there are residue of ice, inter-cycle icing, on the also rear that are unprotected.

CHAIRMAN HERSMAN: And I don't know if we have that up yet. It looks like they stayed within the certification envelope, but I think that chart was just focused on drag.

MR. CAIHOL: Not only drag. There are also the lift that was --

CHAIRMAN HERSMAN: Okay, I'm sorry. It wasn't that presentation, it was the one that has the certification envelope and the lines and the red lines right on the edge of the dotted black line. So if we're just looking at this chart, though, is it just focused on the ice or it's focused on the drag, not part of the asymmetry or it's incorporating that, too?

MR. CAIHOL: The drag we have computed for the actual aircraft taking into account the aircraft condition. I mean the partial flap extension and the gear that were extended.

CHAIRMAN HERSMAN: Okay. So, in totality, everything that was going on is reflected here?

MR. CAIHOL: Yeah. And we have compared this drag with the certification drag that -- for the flap zero condition and flap -- for the flap zero conditions -- and committed configuration.

CHAIRMAN HERSMAN: Okay. So once they have both of these events, kind of they're skirting right along the edge of this envelope that they're -- the certification envelope. Do the two different events require potentially different actions? Is there a down side to cleaning up the airplane? How does that affect the performance? Let's say they pulled the landing gear back up, you know, what --

MR. CAIHOL: No, there is no other possible -- other than to maintain the speed, the minimum icing speed, and fly the aircraft until the landing.

CHAIRMAN HERSMAN: Okay. Thank you very much. Any additional questions from the Tech Panel?

MR. BURTCH: I know you don't want to hear it. I have two quick ones, just to clarify. Does APM require any knowledge of the ice that they're encountering?

MR. CAIHOL: You need to know the aircraft's limitation session, and the APM asks the flight crew to be vigilant and monitor the icing condition as per the visual cue we have established, so it doesn't care about the outside icing conditions, only further ask the flight crew to monitor the outside icing condition is flying.

MR. BURTCH: So again to clarify, it could be Appendix C, it could be beyond Appendix C. The APM system would activate and alert the crew to -- an unsafe condition.

MR. CAIHOL: The APM analyze drag, only provide information related to the drag to the flight crew and but doesn't matter if it is a normal icing condition between bracket in Appendix C or outside the Appendix C envelope.

MR. BURTCH: Thank you. Last one. Does APM require the recording of that data, of the parameter, for whatever parameters --

MR. CAIHOL: No.

MR. BURTCH: -- are used for the system? Is there a requirement that you record those data, or are they just used and --

MR. CAIHOL: We use the parameter that are recorded. When the APM is install, we are recording the signal provided by the APM.

MR. BURTCH: But you do not -- do you need to record them to data and pull them off the airplane after the flight? I mean, there's not a requirement for a history of a flight, in essence?

MR. CAIHOL: No.

MR. BURTCH: You monitor the aircraft during the flight, actively, and then post-flight there's no requirement to keep that data; is that correct?

MR. CAIHOL: No.

MR. BURTCH: I just wanted to -- thank you.

CHAIRMAN HERSMAN: Parties have any additional questions? Mr. Harris.

MR. HARRIS: I do apologize for one additional question. Mr. Caihol, are there configurations of the aircraft associated with landing that the APM would not be delivering alerts in? I'll rephrase. Does a system deliver alerts when the landing gear or flaps are extended?

MR. CAIHOL: No.

MR. HARRIS: Thank you.

CHAIRMAN HERSMAN: Any other party questions?

MR. MILLS: No, ma'am.

MR. FLANIGIN: None from ATR.

CHAIRMAN HERSMAN: Board of Inquiry? All right, we're running a little bit behind. Let's take a lunch break and try to return back to the room by 1:15.

(Whereupon, at 12:28 p.m., a lunch recess was taken.)

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

(Time Noted: 1:18 p.m.)

CHAIRMAN HERSMAN: Good afternoon and welcome back. We're going to continue with our Witness Panel Number 3 on flight operations and training.

Mr. Broadwater, are you ready to swear in the witnesses?

MR. BROADWATER: We are, yes, thank you.

Gentlemen, if you could please stand. If you could raise your right hand.

(Witnesses sworn.)

MR. BROADWATER: Thank you, you may be seated.

We are ready to begin. The witnesses are sworn in.

CHAIRMAN HERSMAN: Technical Panel, please proceed.

DR. WILSON: Thank you. We're going to begin with Mr. West. Mr. West, thank you for being here today. If you could start by please describing your role and responsibility as Managing Director of Feeder Operations at FedEx.

MR. WEST: As you said, my name's Bill West, I'm the Managing Director of Feeder Operations for FedEx Express. We're part of the air operations division. I joined Feeder Operations in 1992 and was promoted to the current position that I'm in, in 1996. My primary responsibilities are to provide safe, legal and then reliable feeder cargo lift to our internal and external customers. My team and I have overall responsibility for the feeder operation worldwide, utilizing our FedEx-owned fleet of approximately 300 feeder aircraft. These aircraft are leased to seven independent certificated operators in the U.S., one in Canada and two in Europe.

DR. WILSON: Great, thank you. And if you could also describe your aviation background.

MR. WEST: My background basically began in 1992 when I joined the feeder operations group.

DR. WILSON: Okay, great. What criteria does FedEx have in terms of their feeder operations and what criteria do those feeder operations need to meet in order to get a contract with FedEx?

MR. WEST: Well, as I said, our mission statement is based on safe, legal and reliable operations. We deal with companies that are able to deliver that service to us as the customer.

DR. WILSON: So if a company came to you, such as Empire or another company, and wanted to contract with you, what is the process that you go through to determine that the company is adequate to fly your aircraft?

MR. WEST: That company would have to have an AOC approved by the FAA, a good track record, a good safety record, aviation professionals that understand how to run and manage this business. We are lucky in that we have settled on a group of, as I mentioned, seven operators in the U.S. who have flown for us for many years now and have refined their processes and are aviation professionals in every sense of the word.

DR. WILSON: Okay, thank you. And as Managing Director of Feeder Operations, what oversight do you have of feeder operators and specifically Empire Airlines?

MR. WEST: Well, our relationship with the operators are arms-length fee-based relationships. The model, the business model, was built this way in order to promote safety. In other words, these operators have no motivation whatsoever to cut corners on maintenance or flight training or any other aspect of the operation.

DR. WILSON: When you do deal with Empire Airlines, who do you deal with directly?

MR. WEST: Well, we have a communication model that is such that myself, as the Managing Director, would deal primarily, if you look at a horizontal model, with the president of Empire Airlines. And I have a department head who's over our operations group. He would deal directly with the flight operations, the VP of flight ops, for example, for Empire technical services and financial, the financial-related issues on down. However, we're a small department within FedEx, a little unusual for the way the company is set up, and each of the operators are small companies. You know, we bring -- the strategic benefit that we bring to the company is our quick-strike capability, meaning we can be flexible. And so if I need to talk to whomever at Empire, I don't think Mr. Komberec would have any issue with that. But primarily it would be directly with the president of the company.

DR. WILSON: Okay. And so does your department have any oversight or monitoring of safety of the airlines? You did say that safety was your top priority. Do you monitor their safety performance at all?

MR. WEST: You know, I think a term that's been used yesterday and this week has been facilitator, and I would say that's really a very good descriptive term of how we work with these operators. We help facilitate. We want a safe operation. Service is all we've got at FedEx, as you know, and that's what we built our brand on, but it's got to be safe, first and foremost. So five or six years ago we -- six years ago now, I think, we split out our safety functions into a particular on-purpose, dedicated manager to work directly with the safety directors at the operators to help facilitate and improve the overall safety culture of the feeder operation as a whole.

DR. WILSON: And we heard in the last panel about ASAP and FOQA programs that a lot of airlines have. Does FedEx encourage its feeder operators to participate in those programs?

MR. WEST: You bet.

DR. WILSON: How is Empire or other feeder operators compensated by FedEx? Is it by the number of aircraft that are flown, number of packages delivered on-time arrivals, departures? How does the airline get compensated from FedEx?

MR. WEST: As I mentioned, it's a -- our relationship with these operators is an arms-length, cost-plus, fee basis type system and the direct operating costs for the system are just that and they're -- you know, they're passed back to us and the operators are paid a management fee to crew and maintain the aircraft to world-class standards, make sure that all records, aircraft records, are complete and taken care of and that all directives are complied with.

DR. WILSON: And going back to the last question that I asked you, in terms of whether you encourage Empire and other feeder operators to participate in ASAP, in FOQA, have you specifically stated that to Empire, that you would like them to participate in ASAP and FOQA? Or how do you go about encouraging them to participate?

MR. WEST: After the Lubbock accident -- and this is not unusual for our system. Again, in the role of facilitator, we had something of a safety meeting where we brought the ATR or 121 operators in our system together, including our Canadian and European operators, and we sat and discussed -- it's a brainstorming session where we facilitate -- help facilitate, where we can, the ideas. One particular operator had already established and had an ASAP program in place and were extolling the virtues of that program and what they had found in the -- just the benefit that they'd seen in a short period of time. So that issue was on the table and it was discussed and the participants from Empire Airlines considered that and discussed that and have since decided to go forward with that. As I understand it, they are on the cusp of having that approved, which is wonderful news. I think the programs are very, very -- they provide a lot of benefit.

DR. WILSON: Great, thank you. And has FedEx identified any safety concerns that they have specifically with Empire Airlines, in which you've had to address them?

MR. WEST: No.

DR. WILSON: I'd like to switch gears now to the training outsourcing that is done. I know that training is outsourced to Flight Safety International for your feeder operators; is that correct?

MR. WEST: That's correct.

DR. WILSON: Does FedEx observe the training that's provided by Flight Safety?

MR. WEST: Again, our role with the flight training provider is one of a facilitator. If I could step back, the business model is such that at the end of the day we're really contract managers. We have a contract with this company to fly our flight schedule. We pay them for their aviation expertise. Where we can come in and offer FedEx leverage, buying power to, say, buy world-class aviation -- I mean, airline quality flight training, we'll do that and pass that, obviously, to the operators. But for things like the curriculum development and continuous improvement throughout the life cycle of that program, that's what the operators are there for. They're the aviation experts, and that's what we pay them for. They work directly with the flight training provider, in this case Flight Safety, to continuously improve that process. Yes, we observe, yes, we're involved in terms of, you know, we need to know what's going on so that we can help understand any issue that may come up or what have you. But at the end of the day, it's the operator and ensuring that they are getting what they need to meet the terms of their operation specification in the training program as approved by the FAA.

DR. WILSON: Given that the feeder operators operate aircraft that are owned by FedEx, for instance, the ATR, it would seem that FedEx would want to know that the pilots are being adequately trained. Is there any method that you go about at FedEx to ensure that the pilots are adequately trained by Flight Safety?

MR. WEST: Well, we know the folks at Flight Safety very well. We have a longstanding, very productive relationship with the pros there at Flight Safety, and if there were trends or unfavorable issues that they may see or what have you, I'm sure they would talk to us about it. I mean, you know, we're not -- we keep our ear to the ground, but we know that the operators, especially the core group that still -- that works for FedEx, they've been in this business long enough to know that, you know, we have certain metrics and certain expectations. Obviously safety is number one. And as you know, a well-trained pilot is probably your most important safety tool. And I'm sure that the operator realizes that they couldn't deliver the kind of safety record, safety profile, what have you, to us without a very well-trained pilot.

DR. WILSON: And how was the decision made by FedEx to outsource the training to Flight Safety, specifically?

MR. WEST: Well, FedEx doesn't operate the ATR. We don't provide any in-house training. I mean, it has to be done either -- we either go to a company like Flight Safety or the operators themselves would do the training. Again, out of a collaborative type effort, working utilizing the FedEx leverage and buying power, we felt the best deal overall in terms of the quality of the training and the financial aspects of the arrangement were such that Flight Safety was the best alternative.

DR. WILSON: And just to clarify. And I think that you've answered this in roundabout ways, but does FedEx provide any guidance to Flight Safety, as to what it wants to see in the training for the pilots who are going to be flying your aircraft?

MR. WEST: No.

DR. WILSON: Does FedEx provide any guidance to the actual operators about what they'd like to see included in the training?

MR. WEST: No. It's more the other way around.

DR. WILSON: Okay. And one of the things that we -- when we interviewed at Flight Safety International, the instructors who trained the flight crew and others at Empire Airlines, that some of them did not have operational experience or on-the-line ATR operational experience. How important do you think it is that the instructors who are training the flight crew have this sort of on-the-line operational experience?

MR. WEST: I'd be speculating.

DR. WILSON: Okay, you mentioned that, after the accident, FedEx held a safety meeting with the feeder operators to discuss some of the issues. What other changes are you aware of that Empire or other feeders have made since the accident?

MR. WEST: As Randy Lanfell mentioned yesterday, there have been numerous changes and I think, you know, those changes are operator changes, so it's best that, you know, those items come from them. I think that makes the most sense. I am, you know, super excited about the opportunities the FOQA program may allow in terms of training and the improvement that you can use that data for improved training. And of course the ASAP programs are really -- I'm really a big believer in those, that process and the way that it generates, you know, threat assessment or threat -- I forget what the exact term is, but generates items that can be worked on within the operation itself.

DR. WILSON: And did FedEx play any role in the changes that Empire has made since the accident?

MR. WEST: Only from the standpoint of facilitating where we can.

DR. WILSON: And one of the changes that Empire has made is to no longer allow the ATR to dispatch in freezing rain or freezing drizzle. As the owner of the ATR, has FedEx provided that sort of suggestion to other feeder operators, that they may want to reconsider dispatching their aircraft in these type of weather conditions?

MR. WEST: We have not.

DR. WILSON: We heard in the last panel as well that the ice evidence probe was provided by ATR and then from there the operators were required to install the ice evidence probe on the airplane. We know that FedEx gave the ice evidence probes to Empire. Was there any sort of timeframe that FedEx gave to Empire for installing these ice evidence probes?

MR. WEST: The modifications to the aircraft are primarily handled by our engineering functions with supplemental air operations. As I understand it, no, there were not timeframes on situations like this. I mean, obviously we like to get them in before the icing season starts, which obviously is closely upon us. And I understand, from our meetings this week, that all of the airplanes have now been retrofitted with the probe.

DR. WILSON: And has FedEx considered purchasing the APM that was discussed as well in the last panel, for the ATRs that you own?

MR. WEST: We have.

DR. WILSON: Could you describe that a little bit more? What stage of the process are you in?

MR. WEST: It's a fairly complicated issue having to do, I think, with a new FDAU that we're -- flight data acquisition units that we're putting on the airplane. I'm really not the person to answer that question, other than to know that, you know, we've looked at it and we understand the capabilities and we are in favor of moving forward with that mod.

DR. WILSON: And has FedEx changed the -- I know that the oversight, you said, is really from an arms length. But since the accident, has FedEx changed the way that it monitors or oversees the feeder operators or even Empire, specifically?

MR. WEST: No.

DR. WILSON: Well, I just have one last question for you. Is there anything that we haven't asked you today that you were hoping we would've asked you or an issue that you think would help us with our investigation?

MR. WEST: Nothing that comes to mind.

DR. WILSON: Okay, great. Thank you, I appreciate it. I'm going to turn it over to Captain Gunther now. We're going to proceed with our other witnesses.

CAPT. GUNTHER: And good afternoon, Captain Bonetto. It's a pleasure to have you here. First of all, I'd like to say thank you very much for the time that you took with us in Toulouse, both myself, BEA and Empire's representative, both in the simulator and your training facility. It's much appreciated. Additionally, per your request, I'm going to try to talk as slowly as possible for you, so that way we don't have the Frenglish problem, and as I said before, also your translator can also, if he needs to, step in and talk to me. First of all, Captain Bonetto, prior, could you give us a little bit about your duties and responsibilities at ATR and also your aviation background?

CAPT. BONETTO: Good afternoon, my name is Mr. Bonetto, Captain, ATR. About my background, I started my career as a flight instructor on light aircraft. Then I had been hired by an original airline in Europe, which is called Air Littoral. In this airline I was a first officer on the Embraer 110. Then first officer on the Embraer 120. Then I became first officer on the Fokker 100, and I became captain on the ATR 42, 72. On this aircraft I became a flight instructor, then a flight examiner for the -- after this airline, I was involved in the creation of a new airline, which is called Air Turquoise.

I was involved in the design of the operational manuals, and at this airline I was a flight instructor and flight examiner, and I had the responsibility for the safety management. I'd been hired by ATR at the beginning of 2008 as a flight instructor, a flight examiner, and today I have three functions; I'm a captain, flight instructor and examiner and the responsibility of the safety management system. My activities today is to teach and to examine pilots during simulator session and during line session.

CAPT. GUNTHER: Very good. It sounds like you have a lot of experience. You were a captain for Air Littoral at one time?

CAPT. BONETTO: Yes.

CAPT. GUNTHER: Did you fly the ATR on line?

CAPT. BONETTO: Yes.

CAPT. GUNTHER: And I'm assuming, from your background, that you've also flown other aircraft in line operations as a pilot in commercial operations.

CAPT. BONETTO: Yes.

CAPT. GUNTHER: Yes, okay. Have you ever been a line check airman in addition to an instructor?

CAPT. BONETTO: I've been and I am now.

CAPT. GUNTHER: Okay. From the manufacturer's perspective, how do you train for adverse weather and icing conditions for the ATR?

CAPT. BONETTO: During our approved type rating we have two main parts in the process. We teach during ground courses and during simulator session. During the ground courses we have what we call operational -- where we describe how to operate the aircraft in icing condition during ground operation and flight operation, and all this recommendation and system are reviewed during emergency crew cooperation course and during briefing before simulator sessions. And so we teach during the simulator session as part of our training is normal condition and as part of training is in icing condition.

CAPT. GUNTHER: And from ATR's perspective, when operating the aircraft in icing conditions, how does a pilot operate the deice and anti-ice system in flight for the airplane?

CAPT. BONETTO: We provide the pilots different procedures and checklists to use and to recognize icing condition. We have in the QRH four procedures and checklists which explain how to recognize and how to proceed with icing condition. And we have also another checklist in the emergency part of the QRH, which explains how to operate in case of severe icing condition.

CAPT. GUNTHER: And from a pilot's perspective, as an instructor from the manufacturer, could you describe what the severe icing cues would be for a pilot to be able to determine if they've entered those conditions?

CAPT. BONETTO: Yes. The main indication for pilots is to refer to the -- part of the lateral windows. When pilots see some ice accretion at this part of the aircraft, we consider that the beginning of the severe icing condition.

CAPT. GUNTHER: How does a pilot use the flap system on the airplane? How is it activated and operated by him?

CAPT. BONETTO: Normal operation for flaps, if, as position, meaning in the cockpit, we have a pilot flying and the pilot non-flying and we teach the pilot flying orders for flaps extension. The pilot non-flying proceeds to monitor the flaps extension, and when the position is reached, the pilot non-flying has to announce the position to inform the pilot flying that the flaps position are in the good configuration. Then the pilot flying can compute the new target speed and address the speed regarding the configuration.

CAPT. GUNTHER: And what about any abnormalities, if they go to operate the flap system, if something doesn't work as advertised?

CAPT. BONETTO: We teach abnormal operation during emergency crew cooperation course, and we explain our pilots that the standard process to proceed for anomaly is first detection, the second step is situation analysis, then the next step is decision making. At the beginning of the process I explain we have to detect the anomaly. Whatever the cause of the anomaly, when flaps asymmetry occurs, we teach that that leads to flaps jam situation.

In reference to my previous explanation, when the pilot non-flying monitors the flap extension he can see immediately, after the position in the flaps lever to the 15 position, that the flaps are jammed and we ask our pilot to announce in the cockpit, loudly, the anomaly, which is flaps jammed at maybe five degrees and then explain that we have the detection and the analysis. But that is the main step inside this process, which is to fly the aircraft first. When the pilot flying knows that the flaps are jammed he must announce this and maintain the minimum safety speed first to fly the aircraft. Then we proceed for situation analysis. We explain, in terms of -- that when we have to assess a situation, we have to assess time, external condition and systems. And as flaps anomaly occurs during the final approach, the crew members must first -- the action and we explain that the first analysis is to assess the time. And as well on final, we must apply go-around to register workload on board and to have some time to proceed for the complete anomaly assistance.

When crew members have time, when the trajectory and the workload is under control, the crew members cooperate to troubleshoot the anomaly. Then the pilot flying asks for the relevant checklist. The pilot non-flying proceeds for the checklist, computes the new arrival and approach speeds, and computes the new operational limitations. To end with this anomaly, the pilot flying -- to proceed for the decision and a new arrival briefing. All that validated by the captain.

CAPT. GUNTHER: If, for instance, someone is operating the aircraft in weather conditions and they have reported weather conditions of either freezing drizzle or freezing rain, should the aircraft be operated in those conditions?

CAPT. BONETTO: No.

CAPT. GUNTHER: How about if the aircraft has been ground deiced with an approved deicing program, they have a holdover time which is specified, if those conditions, freezing drizzle, freezing rain, exist still after the aircraft's been deiced, should they depart in those conditions?

CAPT. BONETTO: No.

CAPT. GUNTHER: What is ATR's procedure for setting the airspeed bugs on the aircraft?

CAPT. BONETTO: Airspeed indicators are equipped with static bugs and one mobile bug. For static bugs for approach, for example, we use three static bugs, which are called out. These bugs are computed before the arrival briefing. Regarding the landing weight, these bugs are set, announced and verified by crew members during the arrival briefing. These bugs are in front of the pilots, available to indicate to the pilot the minimum safety speed they have to maintain during the approach phase.

We have one near bug, which is the go-around speed. We have a wide bug, which is the minimum safety speed in normal condition in the configuration flaps at zero degrees. And we have a red bug, which is the minimum safety speed in icing condition, flaps at zero degrees. We also have a mobile bug. This bug is used by pilots to set, announce, and verify the target speed decided by the pilot flying. This speed bug is also equipped with a fast and slow indicator, which alerts the pilot in case of any speed deviation.

CAPT. GUNTHER: And the mobile bug, is that the internal bug?

CAPT. BONETTO: Yes, that's the internal bug.

CAPT. GUNTHER: Does that have another function that has to do with the fast/slow indicator on the aircraft?

CAPT. BONETTO: No.

CAPT. GUNTHER: In other words, if you set that, does that set the fast/slow indicator on the EADI?

CAPT. BONETTO: Yes, that's what is explained. This system is equipped with a fast/slow indicator, which we can refer to on the EADI to inform the pilot in case of any speed deviation from the target speed.

CAPT. GUNTHER: And when ATR trains the use of the fast/slow indicator, is that considered to be something that the pilot should be checking as part of their scan?

CAPT. BONETTO: First of all, the pilot has to maintain this target speed, but the responsibility of the pilot non-flying is to support the pilot flying, and if the pilot non-flying discovers, through this indicator, that the speed is not in compliance with what was decided through this indicator, there is a specific call-out in the cockpit for the crew cooperation, and there is a specific call-out, which is speed, to inform the pilot flying that he has to address the problem.

CAPT. GUNTHER: From the manufacturer's perspective, from the training that you do, do you teach any type of stabilized approach criteria?

CAPT. BONETTO: Yes. In our training manual we have -- which define what is a stabilized approach.

CAPT. GUNTHER: Could you tell me a few of them? Do you know any specifics?

CAPT. BONETTO: Yes. For us, what a stabilized approach is, is when the pilot is stabilized in terms of speed, pitch forward, the aircraft in configuration, the trajectories and the control in terms of localizer, glide, and when all checklists, normal, abnormal and emergency checklists, are completed.

CAPT. GUNTHER: You talked before about if there's a flap problem. For instance, with a flap asymmetry or no flaps, would that be considered to be an abnormal situation or an emergency situation?

CAPT. BONETTO: For us, we teach that's an abnormal situation.

CAPT. GUNTHER: Okay. And so go-around with a flap asymmetry or zero flaps or a flap jam, you've done that more than once, I'm assuming?

CAPT. BONETTO: Could you please repeat the question?

CAPT. GUNTHER: For in training purposes, when ATR trains, let's say flap asymmetry or no flaps or a flap jam, you were saying before that you teach go-around?

CAPT. BONETTO: Yes.

CAPT. GUNTHER: Okay. And that buys time? Is that what you're saying --

CAPT. BONETTO: Yes.

CAPT. GUNTHER: -- it buys time for the flight crew?

CAPT. BONETTO: Um-hum.

CAPT. GUNTHER: Okay.

CAPT. BONETTO: Okay.

CAPT. GUNTHER: I'm just clarifying because --

CAPT. BONETTO: Yes, exactly, okay. Because we really need to have more time to proceed for the --

CAPT. GUNTHER: Okay.

CAPT. BONETTO: -- procedure on the --

CAPT. GUNTHER: In this aircraft, it's equipped with T-2 casts, which is, in Europe and France, you may know them as EGPWS.

CAPT. BONETTO: Correct.

CAPT. GUNTHER: When you teach the aircraft, if they get an EGPWS warning, are there any specifics that they should be doing?

CAPT. BONETTO: We teach that the EGPWS, for us, provides some alert or warning in case of risk to some have collision with the ground. This equipment provides some alert or warning. When a pilot gets this information on board during icing condition and/or night condition, they must apply an immediate go-around.

CAPT. GUNTHER: And Captain Bonetto, are there any types of cues, for instance, that would differentiate a flap asymmetry with any other type of flap failure in the cockpit? Is there anything that the pilot would either see or feel that would indicate that they have that problem, whether they're hand-flying or whether they're on autopilot?

CAPT. BONETTO: At the beginning of the malfunction, whatever the anomaly is, we discover that there is a malfunction through the flaps indicator. Then, when crew's available to troubleshoot the anomaly, they have some indication which can help them to understand the difference between the flap jam or flaps asymmetry. For example, if the aircraft is under autopilot, there's some information triggered by the -- on the ADU and on the ADI, which provides -- between roll left or right wing down.

And when pilots proceed for troubleshooting, they can see outside to refer to the -- to see the exact position of the flight. This information is available from the cockpit and -- by cooperation between left and right wing flap position, we can see if the flaps are jammed or asymmetry. And there is other information regarding the control wheel, which are inclined to the left or to the right, depending on the asymmetry.

CAPT. GUNTHER: And when Captain Martini and myself and Mr. Nicolas, from BEA, were in simulator, we noticed that there were these indications that were in there. You've also flown the line in the aircraft. Have you seen the flashing of the ADU like that before, yourself, on line? Does the simulator replicate the aircraft?

CAPT. BONETTO: Yes, exactly.

CAPT. GUNTHER: Okay. We also noted before, from the animation, that the power levers, in other words, on the aircraft, the throttles were back for quite a long period of time. If the aircraft had been equipped with an APM, would the APM have found out that the aircraft was decelerating at that point? Would it have been able to determine that there was a problem?

CAPT. BONETTO: Not in this situation.

CAPT. GUNTHER: Okay. And is there anything that I haven't asked you that you might want to share with us or discuss with us today that could help us with our investigation?

CAPT. BONETTO: No, thank you.

CAPT. GUNTHER: I have no further questions for this witness, and we'll now move on to Captain Steve Martini. Captain Martini, welcome.

CAPT. MARTINI: Thank you.

CAPT. GUNTHER: Thank you. To start off with, could you give us a little information about your duties and responsibilities at Empire Airlines and also your aviation background?

CAPT. MARTINI: Yes. I'm the Chief Pilot for Empire Airlines. I started with the company back in 1985. I was hired on to work the line department. I soon obtained my private pilot license in August of that same year and then received my instrument rating in June of 1986. I received my commercial license in June of 1988 and my multi-engine rating in May of 1987. I did obtain my ATP license in May of

1999 -- excuse me -- '91 and then I was qualified as a first officer on the SA227 Metro. After a while of flying that equipment, I transitioned over to the F27 as a first officer and then received in that time period type ratings in the SA227, the Fokker F27, 500 and 600, ATR 42, 72, and also the Shorts 360. Most recently, I just became qualified in the Cessna Caravan. And I've been a chief pilot for the 121 side of the operation since 1998 and just currently accepted the position of chief pilot for the 135 side also.

CAPT. GUNTHER: And I'm assuming you have a pretty good memory because you did the majority of that without reading the paper.

CAPT. MARTINI: That's pretty good, huh?

CAPT. GUNTHER: Yeah, good. Who do you report to, Captain Martini?

CAPT. MARTINI: The Director of Operations, Randy Lanfell.

CAPT. GUNTHER: Okay. And do you report to anybody else in the company?

CAPT. MARTINI: Tim Komberec, also.

CAPT. GUNTHER: Okay. We heard from the gentleman from FedEx regarding how the program works with the feeders. Do you interface with just the airline or do you yourself also interface with anybody from Federal Express?

CAPT. MARTINI: I also speak with the field administrators.

CAPT. GUNTHER: And what do the field administrators' job do? What do you interact with them on?

CAPT. MARTINI: We coordinate with them issues that we may have at different FedEx locations, with marshalling issues, loading issues, setting up parking positions for the aircraft, that type of thing. Typically ground operation issues.

CAPT. GUNTHER: Okay. So, at FedEx, the interactions you have are mostly on the freight handling side versus the flight side?

CAPT. MARTINI: Yes.

CAPT. GUNTHER: Flight operation side.

CAPT. MARTINI: Correct.

CAPT. GUNTHER: Do you ever discuss with them anything that has to do with flight operations or flight safety?

CAPT. MARTINI: No, not flight safety. If there is an issue, I would bring it to their attention. But typically we work those issues out within the house. No, nothing that could go towards the field administrators, as far as that goes. Just typically ground operations.

CAPT. GUNTHER: How about with other feeders, for instance, Mountain Air Cargo or other operators?

CAPT. MARTINI: On occasion I might speak with their

DO or chief pilot. They might be interviewing a pilot that we used to employ in the past, so they might call.

CAPT. GUNTHER: How about on operational or safety issues?

CAPT. MARTINI: Not that often.

CAPT. GUNTHER: And Mr. Tubbs discussed the fact that he interfaces with Captain Lanfell on a regular basis. Do you also do that?

CAPT. MARTINI: Yes, I do.

CAPT. GUNTHER: Okay. And is that in regards to the flight operations or any type of safety concerns?

CAPT. MARTINI: Yes.

CAPT. GUNTHER: How would you characterize your workload as a chief pilot? You were talking, apparently you wear many hats over there. You're chief pilot for the ATR, and if I understood you correctly, also the 20A program.

CAPT. MARTINI: Correct.

CAPT. GUNTHER: Okay. And you were also in the training department?

CAPT. MARTINI: I was, but not currently.

CAPT. GUNTHER: Okay. Why are you out of the training department?

CAPT. MARTINI: When I accepted the chief pilot position for the 135 side of the operation, everything pushed all of my instruction training duties and we do have a manager of training now, training now, so she takes care of that.

CAPT. GUNTHER: And did your manager of training -- I'm assuming it's a she. Did she have any previous positions where she either operated the ATR or had been in a safety position prior?

CAPT. MARTINI: Not prior to Empire, to my best knowledge.

CAPT. GUNTHER: Okay. How about a training position?

CAPT. MARTINI: I'm sorry?

CAPT. GUNTHER: A training position.

CAPT. MARTINI: She wasn't involved in training prior, yes.

CAPT. GUNTHER: Do you know if she was a check airman, a line check airman?

CAPT. MARTINI: She was a check airman.

CAPT. GUNTHER: And I'm assuming she's typed on the aircraft now.

CAPT. MARTINI: Yes.

CAPT. GUNTHER: When you do hiring, you were mentioning before that you do discuss with other feeder operations about hiring of pilots, in other words, maybe a specific pilot. Do you have any -- Captain Lanfell mentioned that you have certain criteria. What exactly are you looking for in a pilot when you're hiring him?

CAPT. MARTINI: Well, a lot of things. We're typically looking for crew members that have done single-pilot cargo operations, that have been able to make decisions on their own. If we're looking for a first officer, that's what I typically look for, time and experience. If they've taken or had CRM training before, in the past, what type of equipment they're flying, and of course other qualifications and how many hours they have.

CAPT. GUNTHER: And what's your minimum hiring? Do you have a certain minimum number of hours or does that depend on where they came from, their background?

CAPT. MARTINI: Yeah, that varies from the 121 first officer and captain or the 135 captain. There are different hourly requirements.

CAPT. GUNTHER: Okay. So in some instances you hire directly into the left seat?

CAPT. MARTINI: Correct.

CAPT. GUNTHER: On both aircraft types?

CAPT. MARTINI: Yes.

CAPT. GUNTHER: How do you make a determination that that person is eligible for a captaincy?

CAPT. MARTINI: Through the hiring process.

CAPT. GUNTHER: Can you be a little more specific?

CAPT. MARTINI: We bring them in. We first start out with a phone interview after reviewing the resumes, and if they go through the phone interview and pass that portion of the interview process, we will invite them over for a face-to-face interview. And at the face-to-face interview, we will give them a written test and put them on a simulator that we have, and we've got a syllabus that we follow for each individual, as far as steep turn in slow flight, how they hold altitude, NDB approaches, ILSes -- arcs. We evaluate their performance that way on the simulator, and if that goes according to plan, we make them a conditional offer based on receiving information on their background check and we offer them an opening.

CAPT. GUNTHER: And then I realize that you probably, under the present economy, have not hired anybody in quite some time.

CAPT. MARTINI: That is correct.

CAPT. GUNTHER: Okay. When you start rehiring, will you be using those same hiring criteria that you used before?

CAPT. MARTINI: Yes.

CAPT. GUNTHER: So will you still be hiring people directly in the left seat in some instances?

CAPT. MARTINI: I don't think we're going to have that issue. Our first officers have all got the requirements for the left seat, and so we would take it via seniority from that point.

CAPT. GUNTHER: Captain Lanfell mentioned about the documents that they're required to have on board, basically just the GOM, and I guess that was at the time of the accident.

Has that changed since then?

CAPT. MARTINI: No, a GOM is required for the crew member and also their navigation charts.

CAPT. GUNTHER: Okay. And what about the pilot handbook?

CAPT. MARTINI: The pilot handbook is now installed on each aircraft.

CAPT. GUNTHER: And does that contain the information that's either out of the FCOM or the AFM that's printed either -- the FAA-approved document or the FCOM that's produced by the manufacturer?

CAPT. MARTINI: Yes, it does.

CAPT. GUNTHER: And that would have specific icing information --

CAPT. MARTINI: Correct.

CAPT. GUNTHER: -- in there, and operating the aircraft? Did you know both Captain Holberton and First Officer Cornell before the accident?

CAPT. MARTINI: Yes.

CAPT. GUNTHER: And how would you describe Captain Holberton and First Officer Cornell's personalities?

CAPT. MARTINI: Very dedicated pilots. Both very professional.

CAPT. GUNTHER: Any difficulties or reports to you as the chief pilot, in regards to either their performance or interaction with other crew members?

CAPT. MARTINI: No, nothing.

CAPT. GUNTHER: Have you ever flown with either of them?

CAPT. MARTINI: I have flown numerous times with Rodney. I have not flown with Heather.

CAPT. GUNTHER: Do you remember, during the time that you flew with Rodney, whether you had any emergency or abnormal situations?

CAPT. MARTINI: To the best of my recollection, nothing.

CAPT. GUNTHER: How would you describe Captain Holberton's skills and abilities?

CAPT. MARTINI: He meets all the applicable standards. He's been flying for us for a long time, and we've never had any issues in either the Caravan, the F27, and until this time, with the ATR.

CAPT. GUNTHER: And I understand that he was a check airman on the Caravan.

CAPT. MARTINI: Correct.

CAPT. GUNTHER: And you're type rated on the Caravan, also?

CAPT. MARTINI: Just recently.

CAPT. GUNTHER: In the Caravan, is there anything similar to flap anomaly checklists or anything else similar to the ATR?

CAPT. MARTINI: I would have to pull out the checklist procedures and see.

CAPT. GUNTHER: Okay, I understand. What would you think that Captain Holberton's greatest strength is as a pilot?

CAPT. MARTINI: His ability to interact positively with any crew member that he's paired with.

CAPT. GUNTHER: Are there any areas that he can improve on?

CAPT. MARTINI: Well, we can always improve.

CAPT. GUNTHER: Do you interact with crew scheduling on a regular basis?

CAPT. MARTINI: Not too often.

CAPT. GUNTHER: Okay. Captain Lanfell mentioned two low-time pilots being paired together, what's commonly referred to as green-on-green pairing. Do you have any other areas, any concerns with a pilot, for instance, with 20 years experience being paired with a new first officer?

CAPT. MARTINI: Do I have any concerns with that? No.

CAPT. GUNTHER: What guidance does Empire provide to pilots regarding flight in icing conditions?

CAPT. MARTINI: The guidance we currently have is that we will not depart into.

CAPT. GUNTHER: Materials, for instance, either manuals, training materials.

CAPT. MARTINI: The GOM has a restriction on it that we just currently implemented.

CAPT. GUNTHER: Okay. I noticed when I looked at the GOM pre-accident that you only have that one paragraph in there. The pilots' handbook, which they were not required to carry at the time, has all the FCOM information, which has the restrictions that are in place from the manufacturer for the aircraft. I understand that you've, since that time, placed them on board the airplane. Other than the GOM, okay, and the pilot handbook that's currently on there, are you providing them with anything else, either the winter operations documents from ATR or any other type of advisory materials?

CAPT. MARTINI: Yes, they do have the winter operations document. They also do have the AFM on board the aircraft.

CAPT. GUNTHER: Okay.

CAPT. MARTINI: So that also has that information there.

CAPT. GUNTHER: And is that readily accessible?

CAPT. MARTINI: Yes.

CAPT. GUNTHER: Where's it stored on the airplane?

CAPT. MARTINI: In a flight crew box right behind the captain seat.

CAPT. GUNTHER: Okay. And I understand, since the accident, that you removed the lids on those?

CAPT. MARTINI: That is correct.

CAPT. GUNTHER: Okay. What kind of guidance training does Empire provide flight crews, related to flap anomalies?

CAPT. MARTINI: For the QRH to assess the situation, and when you determine what the situation is, apply the appropriate checklist.

CAPT. GUNTHER: What procedures for the flight crew follow-up they receive a TAWS warning?

CAPT. MARTINI: A TAWS warning would dictate a go-around in normal situations.

CAPT. GUNTHER: You're aware of Empire's descent and approach awareness procedure?

CAPT. MARTINI: Yes, I am.

CAPT. GUNTHER: Okay. Can you familiarize us with some of the standard call-outs?

CAPT. MARTINI: Typically call-out altitude on the descent through 10,000 feet. There's another call-out at 10,000 feet. The landing lights come on, recognition lights come on. The crew typically picks us the ATIS. Whatever level of altitude they've been given, there's a thousand-foot call-out there. The descent approach checklists are completed through 10,000 feet if they've been able to pick up the ATIS and determine which runway they're going to use and what approach. At that point in time through the descent, they would -- the flying pilot would brief the entire approach, the missed approached, figure out the go-around speeds and brief the speeds, set the speeds and complete all the necessary checklists.

CAPT. GUNTHER: And you listened to the CVR, and I'm assuming that you've also seen the transcript.

CAPT. MARTINI: Yes.

CAPT. GUNTHER: Did you either hear or observe on the transcript any of those call-outs being done during the approach?

CAPT. MARTINI: I did.

CAPT. GUNTHER: And which ones were those?

CAPT. MARTINI: When they left altitude they reported altitude. When they got to the assigned altitude, they would give the call L star (ph.), which is what comes up on the autopilot, the ADI, and the checklists were completed, the descent check, approach check, and a brief was given by the captain, bug speeds were bugged, missed approach was briefed. They filed the checklist as far as going back into icing conditions.

CAPT. GUNTHER: And were there any that were missed that you observed?

CAPT. MARTINI: Not that I recall.

CAPT. GUNTHER: Have you taught ground school?

CAPT. MARTINI: Yes, I have.

CAPT. GUNTHER: And I know that in previous conversations that we've had, that during ground school you told us that you give them, for instance, the weather package to look at and things like that. Do you give any specific training either for either identification or operations or identification of supercooled drizzle droplets or supercooled liquid droplets?

CAPT. MARTINI: We teach the crews the identification process of contaminants on the airplane and how to identify that, what type of contaminants it is. We don't typically use the acronym SLD, and normal operations, at least in my 20 years, I've never heard that acronym be presented to me by another crew member. It's typically looking out the windshield, identifying ice of some sort, whether it be rime ice, clear ice, mixed ice, and to what intensity, if it's a trace, moderate, severe. They typically use those acronyms, not really SLD. But we do have a video that does mention SLD in it and a cold weather operations manual does have a chapter -- excuse me -- a paragraph or two discussing SLD.

CAPT. GUNTHER: In your FTM it discusses SCDD. As a matter of fact, the acronym is actually spelled out in the flight training manual.

CAPT. MARTINI: Yes.

CAPT. GUNTHER: How do you teach that?

CAPT. MARTINI: Supercooled drizzle droplets.

CAPT. GUNTHER: Yeah.

CAPT. MARTINI: We discuss the formation of supercooled drizzle droplets, what conditions it takes for those to form on the aircraft, and let the crews know that that is a possible contaminant they need to be aware of.

CAPT. GUNTHER: And the meteorology, it's the heading in that section, is ATR ground school or ground training, is that taught by Empire, in-house, or is that done at Flight Safety International, for the adverse weather section?

CAPT. MARTINI: The adverse weather section -- excuse me -- is -- I believe that's in our basic indoc. Flight Safety covers the procedures and techniques section that identifies severe icing and the procedures associated with that and how to run the QRH.

CAPT. GUNTHER: Do you have anything that delineates between Flight Safety International and yourself, as to which subject areas will be taught?

CAPT. MARTINI: Yes, we do.

CAPT. GUNTHER: Okay. Do you also do a review of the winter operations guide during ground school? The Be Prepared For Icing document.

CAPT. MARTINI: Yes.

CAPT. GUNTHER: And who's that done by? Is that done in-house or done by Flight Safety?

CAPT. MARTINI: In-house.

CAPT. GUNTHER: And I know that you were type rated and you attended one of the original courses for the company at Flight Safety, regarding the ATR, for your type rating. Have you since that time observed any Flight Safety International ground schools?

CAPT. MARTINI: Yes, I have.

CAPT. GUNTHER: Including CRM?

CAPT. MARTINI: CRM, I have not.

CAPT. GUNTHER: Okay. And how about flight training?

CAPT. MARTINI: Yes, I have.

CAPT. GUNTHER: Okay. Both in the simulator and in the aircraft itself?

CAPT. MARTINI: Yes.

CAPT. GUNTHER: When was the last time you did that?

CAPT. MARTINI: I would be guesstimating. The simulator --

CAPT. GUNTHER: I understand.

CAPT. MARTINI: -- was probably two and a half, three years ago.

CAPT. GUNTHER: Do you regularly do line checks or ride in the jump seat with your crews?

CAPT. MARTINI: I used to do quite a bit of that when I was in the training facility, but lately, on occasion I will go out in the jump seat with a crew.

CAPT. GUNTHER: And who's involved in the development of your training and procedures? Do you have input from both line pilots as well as from both yourself and Captain Lanfell and your check airmen?

CAPT. MARTINI: Yeah, we try to incorporate the check airmen into the design process of our training program, and at times we speak with the line pilots. Those guys have some pretty good information that we can obtain.

CAPT. GUNTHER: Okay. And how about development of the FTM?

CAPT. MARTINI: Typically that is done in-house with the manager of training, our DO, and myself.

CAPT. GUNTHER: And what's the process that's used to determine what you include in training?

CAPT. MARTINI: If we find something that adds to safety, that would be good knowledge for the crews to have, we typically will implement that into the program somehow.

CAPT. GUNTHER: How do you determine if your training and your procedures are adequate and that they're functioning properly? Do you have any type of audit process? Or how do you do that?

CAPT. MARTINI: Yeah, we do have an IEP audit that we've implemented, and in line checks our crew members can observe the crews interacting and follow the SOP. And if there's issues with that, they can report back to myself or report to Randy or manager of training --

CAPT. GUNTHER: Okay. And --

CAPT. MARTINI: -- with feedback.

CAPT. GUNTHER: -- what did you refer to that as, what type of audit?

CAPT. MARTINI: Well, it's an IEP. That's separate than just a line check. It's different.

CAPT. GUNTHER: Okay. Could you explain the process a little bit for us?

CAPT. MARTINI: We have a check airman who's scheduled to go out and fly in the jump seat and just monitor the crew and observe their SOP, use of checklists, procedures, techniques, and they fill out an IEP form that we have, which is then submitted to Randy Lanfell. That information is contained and once we get enough of these audit forms in, we can take a look at all the data and see if we're in compliance in certain areas or maybe falling out of compliance in certain areas and what we can do to improve the operation.

CAPT. GUNTHER: Okay.

CAPT. MARTINI: Which may take a change or implementation to our training program.

CAPT. GUNTHER: And for a new pilot such as Heather Cornell, the first officer, what type of training would that new employee receive?

CAPT. MARTINI: In regards to?

CAPT. GUNTHER: Well, if you can, step me through the process of, once they're hired as a pilot, what type of training they would receive before they actually are put on line as a first officer.

CAPT. MARTINI: Okay. At the time that Heather was hired, the interview process goes on. We offer the position. She comes to Coeur d'Alene. We put her through two days of company specific information. Then she is with us for another five days, one week of basic indoc. After that's complete, she's flown down to Houston, Flight Safety. We put the crews up down there and provide them per diem.

They go through two weeks of systems ground school at Flight Safety, followed by two weeks of simulator training. They receive a check ride with a designee down there at Flight Safety. Once that was completed, we fly them back up to, typically, Spokane, put them in the actual airplane with another check airman, give them two days of flight training in the aircraft, doing the same maneuvers that they did in the sim, steep turns, stall recovery, ILSes, two-engine, single engine, aborted takeoffs, the one-cuts. Once that's completed, they're signed off again after that check ride and then they're given to another check airman to complete 20 hours of ILE.

CAPT. GUNTHER: And when they're doing that, do they train for multiple emergencies or more than one anomaly at a time?

CAPT. MARTINI: That's at the discretion of the check airman. Typically in the airplane, because it is riskier, one anomaly. In the simulator, during the training process, they can load a person up.

CAPT. GUNTHER: Okay. We talked about stabilized approach criteria before. Would you consider this approach stabilized per your criteria?

CAPT. MARTINI: Which approach, the accident?

CAPT. GUNTHER: The accident approach.

CAPT. MARTINI: No.

CAPT. GUNTHER: If the flight crew followed the published procedures, do you think the outcome of the flight would've been in doubt?

CAPT. MARTINI: I don't think that's for myself to answer. I wasn't there. I have to depend on the crew to take a look at the situation they have at hand and make the correct determination in reference to safety and make the call.

CAPT. GUNTHER: Prior to the simulator session that we had together, the six hours that we spent in Toulouse, did you know the cues that a pilot would see or feel if they'd been faced with a flap asymmetry?

CAPT. MARTINI: I don't recall that I've ever had a flap asymmetry in training or recurrent training. I'm not 100 percent sure, but I can't recall one. The cues, as we discussed, what would happen with the aircraft, it would slightly roll --

CAPT. GUNTHER: Okay.

CAPT. MARTINI: -- from the cockpit.

CAPT. GUNTHER: Have you -- okay. There wouldn't be any type of wheel displacement or message on the ADU? Or had you never observed anything like that --

CAPT. MARTINI: I have not --

CAPT. GUNTHER: -- prior to the simulator?

CAPT. MARTINI: -- observed that.

CAPT. GUNTHER: Okay.

CAPT. MARTINI: I would assume that there should be, but I've never observed it.

CAPT. GUNTHER: I just have a few more questions. Are you doing okay?

CAPT. MARTINI: Just fine.

CAPT. GUNTHER: Okay, great. Actually, I really have only one more question for you. Is there anything we haven't asked you about that you'd like to discuss here today and that could help us with our investigation?

CAPT. MARTINI: No, sir.

CAPT. GUNTHER: Okay. Anybody else? Anybody else? Okay, thank you, Captain Martini.

CAPT. MARTINI: Thank you.

CAPT. GUNTHER: Now I'm going to hand it over to Mr. Tim Burtch.

MR. BURTCH: Thank you. Thank you, Todd.

Good afternoon, Mr. Sparrow.

MR. SPARROW: Good afternoon.

MR. BURTCH: Could you give us a brief summary of your background, qualifications and duties?

MR. SPARROW: Yes. I'm the manager of the FAA National Simulator Program. We are a remotely sited branch in Atlanta, Georgia. I report directly to the Flight Air Transportation Division in Washington, D.C. My background is I learned to fly in the Army in 1970. After I got out of the Army I flew cargo, flight instruction, corporate, charter, regional airline, international airline, and flight instructor with the National Guard, and then I came to work for the FAA.

MR. BURTCH: Thank you. You have a few slides to describe?

MR. SPARROW: Yes, I do.

MR. BURTCH: Are you ready?

MR. SPARROW: Absolutely. I put these slides together just as a little bit of an overview of what we do. We have the responsibility for all FAA-approved simulators in the world. And as you can see from the slide, we also work internationally with other countries. We're doing quite a bit of that right now. Next slide, please.

As you can see, we are charged with setting the standards and criteria for the evaluations of these simulators. We currently work with 700-plus simulators. We average from 20 to 45 new simulators a year that come on line, and with the economy, we've seen a number drop off of the older ones slightly. We also work with Level 4 through 7 flight training devices as well. We also have the assistance of the FSDOs in the field to do the evaluations on the Level 4 and 5 flight simulators or flight training devices.

Our operations inspectors also work with flight standardization boards on all new aircraft that we are invited to work with, as well as occasionally on the Flight Operations Evaluation Board. We have found that the earlier we can work with a new aircraft, the better it is as far as the development of the simulator. It is certainly the option of the simulator manufacturer of whether or not we're involved with them as they construct the simulator. And we're certainly not there to tell them how to build it. However, when questions come up with a new type of aircraft, we're readily available to assist them either on site or remotely for questions. This helps with the initial certification process. Next slide, please.

As you can see, we stay pretty busy with new aircraft that are coming down the line. These are just a few of the ones that we're working with. We also do helicopters as well. The Extended Interval Inspection Program allows, with the Part 60 rule, for us to extend inspections by our inspectors. That is something that is currently being fielded. And we have a database which we call SISE (ph.), which is where we store all of our information. Next slide, please.

This is just a clip of some of the items that are generally associated with the different levels of flight training devices. Next slide.

And another of motion simulators, A through D. That's all I have of slides.

MR. BURTCH: If we could speak specifically to the accident, what are the asymmetric -- let's start with icing, the icing requirements for the ATR 42 full-flight simulator?

MR. SPARROW: Well, I have a little information here I'd like to read you, if I may, that might give you a little bit of a basis of what we look at. Until Part 60 came into place, which is May of last year, the simulators were weighed against standards that we had published. There are currently nine Advisory Circulars that are still in place. Although they have been superseded by Part 60, the simulators, they were initially certified under that Advisory Circular. We still maintain them to those levels. The Advisory Circular 121-14C, which came about in 1980, the general requirements of all FAA-published and internationally recognized simulator standards require the simulation of airframe and engine icing for qualification of Level D simulators. More recent simulator standards from Advisory Circular 120-40B, which was in '91, up through Part 60 and the European JAR Standard 1A, Amendment 3 standard, expanded this requirement to include Level C simulators as well.

I have a procedure here, if I may, I'd like to read you out of Part 60. It's what we use when we go to look at a simulator.

MR. BURTCH: Certainly.

MR. SPARROW: With the simulator airborne in a clean configuration, nominal altitude includes airspeed, autopilot on, and auto-throttles off, engine and airfoil anti-ice and deice systems deactivated. The instructor would activate icing conditions at a rate that allows monitoring of simulator and system response. Icing recognition will include an increase in gross weight, airspeed decay, change in simulator pitch attitude, change in engine performance indications other than due to airspeed changes, and change in data from pedostatic system. You would then activate the heating anti-ice or deicing systems independently. Recognition will include proper effects of these systems, eventually returning the simulated aircraft to normal flight. That's how we evaluate a simulator.

MR. BURTCH: Is that an objective test or is that more subjective?

MR. SPARROW: Subjective.

MR. BURTCH: Is there an objective test for ice required for qualification?

MR. SPARROW: No.

MR. BURTCH: Changing to asymmetric high lift, does this fall into that same category? How do you test a simulator for an asymmetric high lift failure?

MR. SPARROW: We would have the operator put the abnormality in and we would look for the indications that would normally be associated with that in any aircraft. We also have a subject matter expert in the simulator, who is typed and current in the aircraft, in case we have questions. So if, say, you were to fail the left flap at two degrees, you would expect some rolling motion. We look for it and it's subjective. If we have a question, we ask them.

MR. BURTCH: So again, that's a subjective test. There's not a requirement for test data, flight data, to validate the simulator in these areas?

MR. SPARROW: In that particular item, no. Now, we do run a number of automatic tests and some manual tests that are across a broad spectrum, but it's mostly to check the software interaction with the hardware.

MR. BURTCH: Does the new Part 60 include objective testing either in, or in both, the icing and the asymmetric high lift?

MR. SPARROW: What I'd like to tell you is that the flight test objective validation of icing conditions is not required for qualification of training simulators under any recognized FAA or international standard at this time.

MR. BURTCH: Thank you. The regulatory basis for the flight safety simulator, what is that?

MR. SPARROW: As far as what we look at?

MR. BURTCH: The document. Is that a 120-40B, 120-40C, Part 60?

MR. SPARROW: It depends on the simulator. I would say, at this time, there are currently six Level C simulators within the system that we are tracking, two Level D simulators. Of the six Level C simulators, two of them are out of action. They're being moved, so they're not functioning. All simulators, as of last week when I checked, had no open discrepancies. These belong to different customers, though.

MR. BURTCH: I guess to clarify, do you know that the simulator -- we're talking about the training that Empire does with Flight Safety in Houston, that device, the Level D, do you know the certification basis for that simulator?

MR. SPARROW: 120-40B.

MR. BURTCH: Thank you. What does Level D mean?

MR. SPARROW: Well, the chart up there I showed you kind of gives you a breakdown of it.

MR. BURTCH: Can you describe it?

MR. SPARROW: Sure.

MR. BURTCH: Yeah.

MR. SPARROW: A Level D simulator control loading, static and dynamic control loading, visual displays, night-dusk-day scenes, motion freedom, six degrees of freedom, the visual view is 180 by 40, 40 -- pardon me -- 40 being vertical and 180 to the left and right. The sound, realistic cockpit noise. Data package, ground handling package. Fidelity. Feel and see some of the runway contaminants, and operating radar.

MR. BURTCH: Thank you. How does ATR model icing in the simulator?

MR. SPARROW: Are you speaking about ATR, the company? Because they don't do that. Flight Safety --

MR. BURTCH: How does Flight Safety model --

MR. SPARROW: Okay.

MR. BURTCH: -- that?

MR. SPARROW: Flight Safety was provided, along with all of the simulator operators, a package which was developed after Roselawn incident, accident. It's a freezing drizzle icing model provided to the ATR 42 simulator operators by the aircraft manufacturer in 1996, to address handling qualities, issues, identified during the accident investigation process. So when we go to look at a simulator, regardless of who owns it, for an annual evaluation, that is currently installed in the simulator, which, to my understanding, they all have them now, we check it.

MR. BURTCH: How about asymmetric high lift, the flap asymmetry, how does either Flight Safety or ATR model that failure?

MR. SPARROW: Well, they would put in a software code that would give, to the best of their ability, what the aircraft would do. They may or may not have the flight test data package from the original certification. If they did, it would be their option to use some of that information and developing their software for these anomalies. However, I can't say specifically, at this time, what they did exactly to give that anomaly, but I can get that information for you, if you would like.

MR. BURTCH: Thank you, that'd be great. Does the FAA include Appendix C ice shapes in the simulator models?

MR. SPARROW: There's no requirement for that.

MR. BURTCH: Do recurrent inspections of the simulator include the asymmetric high lift and icing effects? Is that something that's looked at on a recurring basis, either the six-month or the yearly re-inspection that the simulators are required to go through?

MR. SPARROW: Would you restate that question?

MR. BURTCH: For recurrent qualification -- and let's speak to the Flight Safety simulator -- are the areas of asymmetric high lift and icing revisited and looked at with each recurrent visit?

MR. SPARROW: The evaluator, the inspector, does not check a hundred percent of everything on the simulator with recurrent evals. I'd have to pull each package to look at it, but they have the option of moving through each of the different systems and spot checking to see that things are working correctly. On the initial evaluation, we check a hundred percent of everything, but that takes a week. We've got four hours. Now if we need more time, we take it on a recurrent evaluation. I could say, generally speaking, we probably do, but I would have to look at each specific evaluation to tell you that. It is not a requirement.

MR. BURTCH: Thank you. That's all the questions I have.

MR. SPARROW: You're welcome.

DR. WILSON: Does anyone else on the Technical Panel have any questions for these witnesses?

(No response.)

DR. WILSON: Madam Chairman, we're done with these witnesses.

CHAIRMAN HERSMAN: Thanks. We'll go to the FAA first.

MR. HARRIS: Thank you, Madam Chairman. As you can imagine, there's a lot of information here, so there may be a significant number of questions.

I'd like to start with Mr. Sparrow. Thank you for your testimony. There were some questions there related to the spot checking and recurrent checking of simulators and I recognize that the inspector conducting that evaluation would not check 100 percent of the items. Is there an obligation of a sim operator to identify malfunctions that occur or failures of a simulator performing as designed during their operational use and in some manner control its use relative to that particular training?

MR. SPARROW: Absolutely, the responsibility is a hundred percent theirs. Any time that they have a malfunction during training or during their checking of the sim preflight or post-flight checks, it's the maintenance personnel that do. They are supposed to write that up. They keep a log of that and that's the start date. And depending on what it is, it will vary in the time they have to get it fixed. I'd also encourage a task restriction self-imposed by them to, let's say, for example, the left engine would not fail. All right. So they could not do any task training on that simulator and get credit for left engine failure, if their curriculum was written that way. So it's imposed upon them to do that. We monitor this. We get information on their discrepancies and we track it.

MR. HARRIS: Anyway, that methodology is not unlike a minimum equipment list on an airplane, where if a piece of equipment becomes inoperative, it limits you from some particular operation, and some kinds of equipment failures would keep you from using the device at all, would that be correct?

MR. SPARROW: Absolutely.

MR. HARRIS: The data that is used to support the development, design development, in manufacturing of a simulator and subsequently used to support the qualification, is sometimes referred to as a data package. What are the typical sources of those data packages?

MR. SPARROW: In some cases the aircraft manufacturer may provide a data package to the simulator manufacturer, especially if they own them, which in some cases that happens. However, the manufacturer has no obligation to do that. Some of them sell the package to them. Others do not. They just don't provide any information. So it is incumbent upon the simulator manufacturer, to the best of their ability, and it's quite a bit more complicated than that, to develop a flight data package that realistically presents the aircraft in the different configurations that they'll be using for training. Our website gives in-depth information on all the requirements for initial evaluations and recurrent.

MR. HARRIS: Thank you very much.

Captain Martini, we've had a lot of discussion today and a little bit yesterday about the actions of crew members during this flight in dealing with a flap anomaly which occurred during approach. In the quick reference handbook there is a set of guidance on procedures initiation as well as a quick reference handbook specific checklist on flight control malfunctions involving flap jam, flap asymmetry and then, I think, flap uncoupling. How deeply do you believe, as the chief pilot and having done training on this aircraft or training as a pilot for Empire, that a crew needs to assess or the term that I'm going to use is going diagnose, which doesn't appear, I don't believe, in your guidance, but how deeply would a crew need to assess a situation in order to start initiating corrective actions?

CAPT. MARTINI: I guess that would depend on the individual and to what point they felt comfortable with determining what the malfunction was.

MR. HARRIS: You mentioned that you flew on several flights or compliance over-flights in the jump seat observing crew members operating within the system. If you were on the jump seat and there was a crew that experienced a flap anomaly in which the selector was moved but the flaps did not go to the selected position, or encountered a stick shaker, or encountered a TAWS alert, what would you expect the crew to do if you were sitting on the jump seat?

CAPT. MARTINI: Do you want to give me the chain of events again? They had a flap anomaly and they had a stick shaker?

MR. HARRIS: No, no, there's an or between those, a flap anomaly or a stick shaker event or a TAWS alert on approach. What would you expect one of your airline pilots to do in that case?

CAPT. MARTINI: Well, with a stick shaker activation, normal operations with no malfunctions, that would be a recovery from the stick shaker. And the crew's flight condition and the training is for max power plus 15 without any malfunctions.

MR. HARRIS: This we're doing during approach and I may not have actually couched that properly. But during approach, if you found a crew that was faced with a flap anomaly or a stick shaker or a TAWS alert, what would be the expected action on their part?

CAPT. MARTINI: Determine the problem and call for the correct checklist.

MR. HARRIS: Thank you.

Captain Bonetto, thank you again for your testimony. Were you present in the boardroom during the discussion of the determination of the minimum of Vref for approach for this aircraft in the zero flaps, icing configuration? Were you here when that discussion was going on?

CAPT. BONETTO: Yes, I was.

MR. HARRIS: And as a simulator instruction you've no doubt seen students operate the aircraft in various ways that were within or not in compliance with the proposed procedures. Do you have an opinion of, from your experience -- let me rephrase that. Not an opinion, but does your experience allow you to comment on what you would expect the outcome of flying at 125 knots with a Vref of 143 would be?

CAPT. BONETTO: In reference to the normal operation, I think it's important to call out, to announce and monitor the speed we need to maintain to fly the aircraft safely. That means that during speed reduction to prepare on approach, we have to anticipate first the configuration, the weather condition and the target speed decided by both pilots before releasing the power.

MR. HARRIS: Again, primarily based on your simulator instruction experience, if a crew had a Vref of 143 knots in the ATR 42 and were operating at 125 knots, what sort of flight handling performance or issues would you expect to see in that condition?

CAPT. BONETTO: If I have to debrief this configuration, I will explain to my trainee that, first, to release the power. We must know exactly what the speed we need to fly the aircraft. And in case of speed deviation, I will debrief to the pilot non-flying that his responsibility is to monitor the speed and to announce any speed deviation to help the pilot flying, which is very busy doing final phase, to address the speed or correct the speed.

MR. HARRIS: Thank you. When you were asked by Captain Gunther about operations in freezing drizzle and freezing rain, your question was -- your answer was remarkably short, that --

CAPT. BONETTO: Um-hum.

MR. HARRIS: -- those operations -- the question was, Is this aircraft qualified for those operations? And your answer was no.

CAPT. BONETTO: Um-hum.

MR. HARRIS: Does the limitation section of the airplane flight manual identify that flight in freezing drizzle or freezing rain is prohibited?

CAPT. BONETTO: In our AFM, which is an approved documentation, in the limitation part we give the pilot a lot of information to explain that in case of freezing rain or freezing drizzle there is a major risk to encounter severe icing conditions. On the same page we explain again that if crew members encounter this situation, they must escape as soon as possible. My understanding is and what I teach is if we have to escape this situation, that means that we're not allowed to enter voluntary in this condition.

MR. HARRIS: Thank you, sir. And in the AFM you use the term or I believe the terms are used along the lines of freezing drizzle or may cause severe icing. But you mentioned a possibility --

CAPT. BONETTO: Yes.

MR. HARRIS: -- or potential.

CAPT. BONETTO: Um-hum.

MR. HARRIS: My question is much more focused. Is there a yes or no bindery kind of prohibition, a statement that says, Aircraft are prohibited from flying in freezing drizzle or not? Does that statement exist? And my sense is, sir, that the AFM shows some information to support decision making, but at least, sir, my reading of it did not reveal that there was a specific prohibition. Is that a reasonable reading of the AFM, to you?

CAPT. BONETTO: I understand your question. It's true that there is no specific prohibition in this page. But as user, as operator and as instructor, I know that this explanation is the limitation part of the AFM and we must take all this information as an anticipation of a very dangerous condition.

MR. HARRIS: Thank you very much. No more questions, ma'am.

CHAIRMAN HERSMAN: Empire.

MR. MILLS: Madam Chairman, Empire has no questions.

CHAIRMAN HERSMAN: ATR.

MR. FLANIGIN: Madam Chairman, ATR has no questions.

CHAIRMAN HERSMAN: Mr. Haueter.

MR. HAUETER: Thank you.

Captain Bonetto, during both your experience as a pilot and also in training, I'm trying to get your idea of when the pilot should or should not use the autopilot in icing conditions.

CAPT. BONETTO: It's really depending on the situation. We explain to our trainees how to operate in icing condition. That's for normal operation during winter weather, to decrease the workload and -- we teach that we must use the autopilot. In case of severe icing, when crew members anticipate and are aware on the risk of this situation, they must disconnect the autopilot. That's part of the emergency procedure, to identify visual cues. And then, when the aircraft is clearly outside this configuration, severe icing or a risk of severe icing condition, I teach that we can reset the autopilot.

MR. HAUETER: Is there a benefit, if you were in icing conditions, to occasionally disengage, feel the aircraft and reengage? Would that be a good procedure?

CAPT. BONETTO: Again, it depends on the condition. We have three main steps to anticipate and recognize icing condition. The first one is entering icing condition. The second one is ice accretion. In this configuration we can use the autopilot. When we are in icing condition, depending again on what are the visual cues, we can have some benefit to disconnect the autopilot to understand what is the aircraft handling and to detect, if we have some indication, to prevent the severe icing. If not, we can reset the autopilot.

MR. HAUETER: Okay, thank you.

Captain Martini, the same question. What guidance do you give your crews on getting the feel of the aircraft in icing conditions?

CAPT. MARTINI: We don't restrict the crews not to use the autopilot in icing conditions, but we do advocate that on occasion, if it's just light or trace, you know, you'd be actually cautious about it, but if you get into moderate icing-type situations, to disconnect the autopilot every once in awhile -- the airplane.

MR. HAUETER: Okay, thank you. And also, Captain Martini, have you ever read our report on the accident at Roselawn, Indiana?

CAPT. MARTINI: I have not read the report, but my initial training through Flight Safety in Houston had that incorporated into their CRM.

MR. HAUETER: Okay, thank you.

And then, Mr. Sparrow, a quick question. I'm just curious on the fidelity of simulators in icing conditions. Is there different levels of icing conditions that are programmed into them? Or how does that work?

MR. SPARROW: The simulator operator has the prerogative to set it up to whatever training programs they're going to be approved for. Typically we see light to moderate. If they wan to, they can put in heavy. It's basically recognition of the accretion of ice that is the typical training value that's looked for. However, that's a little out of my area, so I would have to defer to the training branch for what their guidance is on that.

MR. HAUETER: In the Level D, since you're heavily relying on visual cues of windows, is that shown on the simulator? Is ice built up on the side window or --

MR. SPARROW: No, sir.

MR. HAUETER: Okay, thank you.

CHAIRMAN HERSMAN: Dr. Kolly.

DR. KOLLY: Yeah, I guess I just wanted to follow up with Mr. Haueter's question there. So can simulator training be used to simulate flight into severe icing?

MR. SPARROW: Could it be done? Yes, sir. The typical methods, as I explained earlier, are the increase in weight, the changing of the software -- well, actually software would be written so that the coefficient of lift would have a degraded component so that it would require more pitch. Some basic things like that. But yes, it could be put in there.

DR. KOLLY: Okay. And Mr. Martini, can you explain to me what else outside of that simulator training is taught to a flight crew to recognize flight into severe icing so that they know that they need to exit? What cues are they looking for or what prompts, all the way starting at dispatch?

CAPT. MARTINI: Well, dispatch can play an active role in looking at the weather for the pilots prior to even sending a flight release and the weather to them and they can look for SIGMETs, AIRMETs, you know, pilot reports, that type of thing. And our dispatch does do that. They even could pull up that page on a website that shows the possibility of SLD in certain areas. They look at the weather very closely and then the crew member also reviews it. So they both have to agree that the weather is such that it's safe and legal. And as far as the visual cues for severe icing, we train that through the ATR-provided cold weather operations manual. You know, excessive ice on the spinners, around the unheated portion of the windshield, side window streaming, ice buildup on the unprotected surfaces of the wing, and that sort of thing.

DR. KOLLY: And with regard that aspect of training, how often are your flight crews trained? Is that a recurrent annual training with regard to icing?

CAPT. MARTINI: It would take place in initial and then recurrent also.

DR. KOLLY: Okay, thank you. I have no further questions.

CHAIRMAN HERSMAN: Mr. West, Dr. Wilson asked you about compensation and you talked a little bit about direct cost and reimbursement and management fees. And I'm sorry, I'm not trying to be obtuse, but what I'm trying to understand is how does Empire make a profit and how does FedEx control costs in that relationship?

MR. WEST: The direct operating cost of the aircraft are all billed back to FedEx, and we pay the operator a management fee, based on a formula that we developed through the years, for their expertise in managing the fleet of aircraft that we've leased to them. So their fee is above the operating cost and then the overhead that they have and how well they manage their overhead determines their margin or profit.

CHAIRMAN HERSMAN: Okay. So how well they manage their overhead. They're not really billing everything back to you then.

MR. WEST: Well, no, they -- obviously, the operator has to have a certificate to come to FedEx or, to Dr. Wilson's question, you know, what were the criteria. One is that you have to have an operating certificate, and to have that you have to have certain positions, chief pilots, a director of maintenance, and so forth. And so we understand or we have a formula that's -- I think we've got a lot of mike here somewhere.

CHAIRMAN HERSMAN: Thank you.

MR. WEST: The operator understands the items that aren't billable -- and I think that was on. Yeah, push it down -- that aren't billable to FedEx. And so I mean, for example, if an operator decides they need 12 people to open the mail, that's up to them. They know what kind of management fee they're going to make per airplane, or it's a little more detailed than that, but they know, you know, what their revenue picture looks like and they have to manage the cost side of the equation above the direct operating cost of the airplane. If they put fuel in our airplane, they send me a bill for the fuel.

CHAIRMAN HERSMAN: Okay.

MR. WEST: Okay. But if they hire a secretary, that's part of their overhead.

CHAIRMAN HERSMAN: Okay. But as far as their efficiency goes, are there any incentives to make them, you know, more efficient? And I'm not talking about their overhead. I'm talking about their service.

MR. WEST: We set performance metrics based on safety, reliability, and financial performance metrics that -- you know, we set them out in the beginning of the year. And obviously we've done this for a lot of years now, so we kind of understand where we are. And there are lots of people, I'd say there are fewer now, but there are other companies that companies that could provide this service. So each one of these operators have a built-in incentive to do their best to provide an efficient and safe service to FedEx as they possibly can. You know, again, they understand what the metrics are going in, in terms of safety, in terms of their reliability, and in terms of the financial aspects of running this operation based on this many airplanes and the geographic area they cover and so forth.

CHAIRMAN HERSMAN: So when you evaluate the reliability, does an aircraft that doesn't go because of weather get treated the same way as an aircraft that doesn't go because the crew doesn't show up or because they haven't maintained the aircraft?

MR. WEST: No.

CHAIRMAN HERSMAN: How is that different?

MR. WEST: Our dispatch reliability is measured on feeder-controlled issues, meaning we can't control the weather, and as I think Mr. Perich may have talked about yesterday, the dispatch manager, we don't -- we never question a captain's prerogative to go or not go in weather. We don't make the go/no go decision, and we don't exercise operational control, and we go to great lengths to make sure that the operator, and anybody else who's interested, understands that. But no, if it's ATC gate hold, if it's issues out of the control of the operator, we do not -- we don't charge the operator with a deviation.

CHAIRMAN HERSMAN: Okay. Do you audit your feeders?

MR. WEST: We do.

CHAIRMAN HERSMAN: How do you do that?

MR. WEST: The audits are primarily based on financial audits as well as technical services audits, and that's basically, did we need what -- the way the system works, if an operator purchases fuel for the airplane and sends me a bill, they may send me a bill that's got numerous items on it, including the fuel. So my business transactions team will go in on a periodic basis, once or twice a year, and they'll sit down with the operator and they'll say, Okay, I see here in May you billed us for, you know, 300 gallons of fuel for a Caravan, for example. Show me the invoice where you paid the provider, such that we can determine it's a bona fide expense. So it's a financial audit. And in that audit also, through the years, we refined the process of what's billable to FedEx and what isn't.

CHAIRMAN HERSMAN: Okay.

MR. WEST: To your earlier profit question.

CHAIRMAN HERSMAN: Yeah. Do you do safety audits of your feeders?

MR. WEST: We do. We call it an operational safety assessment. It's not really an audit. It's more of an assessment where we have my -- our safety department will go out. They will observe ground operations. It's primarily more ground operations, mating with the aircraft, the GSC, you know, the ground strikes, the hazards on the ramp type of things.

CHAIRMAN HERSMAN: But not like ride-alongs or check rides?

MR. WEST: They will ride in the airplane, but it's nothing like a check ride or anything like that. The main purpose of being out and doing -- the overriding purpose, I should say, is really to assess what they -- how they feel the safety culture is improving, or what they feel the safety culture is like out there, because, at the end of the day, it's one thing for Mr. Komberec and I to have a meeting and me to tell him, Boy, you know, I'm really -- you know, I want you to make sure you got strong safety. And he says, Well, we do. That's one thing, but it's another thing for my safety guy to be out there on the ramp in the middle of the night talking to the guy that's, you know, the pilot who's flying the flight and he's talking about safety related issues. That's the kind of -- I mean, it's kind of a touchy-feely kind of thing, but that's one way that you know that your safety programs are improving. So to answer your question, yes, we do safety related or focused assessments, but they're not really audits and they're certainly not check rides. We're not qualified to do that.

CHAIRMAN HERSMAN: And if they were to institute a FOQA or an ASAP program, would that come out of their overhead? The cost of managing that program and standing it up.

MR. WEST: Yes.

CHAIRMAN HERSMAN: Okay. Mr. Bonetto and Mr. Martini, were you both involved in the simulator activities on trying to, you know, review this accident?

CAPT. MARTINI: I was, yes.

CAPT. BONETTO: Yes, the same for me.

CHAIRMAN HERSMAN: So did you both have an opportunity to fly this accident flight in the simulator?

CAPT. BONETTO: Yes.

CHAIRMAN HERSMAN: I was just wondering and I know that this is a little bit of a challenge because you knew what you were going to experience and what you were looking for, but how -- just if you could kind of just talk me through it. How would you kind of prioritize your workload and the activities? And maybe try to step back, not just being in a simulator pretending you were in the accident flight. You know, they were experiencing increasing drag, some speed bleed-off, controllability it sounded like on the CVR. They were straining a little bit, needing to trim the aircraft. They weren't on the localizer. They realized that they had a flap problem and were trying to figure out what to do about it. They got stick shaker. They were transferring the control over the aircraft. All of this is happening at the same time and they're at a thousand feet and coming down. Do you expect them to pull out the QRH at that point or should these kind of responses be memory items? And just walk me through how you would expect, you know, kind of not saying if you were them. I'm saying if you were you, how do you prioritize all of these activities?

CAPT. BONETTO: Can I start this? Okay. As you explain, we have a lot of activity in this aircraft. The workload is important. And I am waiting for a pilot to refer to the main information they have in front of us, which is the fact that the flaps are jammed. In this configuration we have to fly the aircraft first to protect the aircraft, address the speed, maintain and announce the speed in the cockpit. And as all, it is -- cues and final, which is very busy. We teach and we demonstrate it during the session, that we have to apply a go-around. The two main priorities for me, first fly the aircraft through the speed, apply a go-around and then, when the aircraft is under control, is safely flying in terms of trajectory and in terms of workload. We can assess the system and then later on troubleshoot and later on enter the QRH.

CHAIRMAN HERSMAN: Mr. Martini, do you want to tell me how you would handle it? And, you know, kind of if you're the captain, you know, taking control from the first officer, all of those things.

CAPT. MARTINI: Well, we tried to mimic the accident flight as closely as we could, and a simulator doesn't necessarily replicate the exact control features that an aircraft does. But I will tell you, when we had the flap asymmetry and tried to reset the power settings to exactly where the crew did, it was a handful. It made me really think about real-life situations in real time. Here we are in a simulator, they can push a button, turn it off and we're safe. Now put yourself out in the field in icing conditions, with the control anomaly with the airplane. It really made me think twice about whether or not I would have gone around. I had a hard time controlling the airplane and getting it lined up with the runway. Even though we did, but I knew it was coming, too.

CHAIRMAN HERSMAN: And were you able to trim the aircraft out so, you know, it could -- you had controllability, level flight?

CAPT. MARTINI: I don't recall if we trimmed it out or not. One time I did not and it was pretty strong control forces, especially when you start off slightly right of the localizer and high on the glide slope.

CHAIRMAN HERSMAN: And were you trying to go around or were you trying to land it?

CAPT. MARTINI: We did that also. I tried to land as such, and I did go around as such.

CHAIRMAN HERSMAN: Did you land or were you short of the threshold?

CAPT. MARTINI: The aircraft actually did not stall. The simulator didn't.

CHAIRMAN HERSMAN: Um-hum.

CAPT. MARTINI: And once again we tried to replicate the exact same thing, that being the condition levers up at the last minute and advance the power levers too, and it did not stall at that time. We did get the wings to dip, just as it showed on the flight data recorder, severely. But the simulator itself flew out of it, but for some reason the airplane didn't.

CHAIRMAN HERSMAN: Mr. Bonetto, do you want to add anything to that?

CAPT. BONETTO: No.

CHAIRMAN HERSMAN: And I was just curious. They got pusher numerous -- I'm sorry. They got shaker numerous times, but the aircraft actually never went to pusher. Why was that? Were they kind of milking it so that it never made it to pusher? Were they doing something right?

CAPT. BONETTO: No, no. In fact, the speed remained above the pusher limit --

CHAIRMAN HERSMAN: Um-hum. Okay. So they just kept it on this side of pusher, but they kept getting shaker.

CAPT. BONETTO: Yes, there is the shaker, and then they increase the power and the speed to recover for a short time the minimum --

CHAIRMAN HERSMAN: Right.

CAPT. BONETTO: -- 50 feet.

CHAIRMAN HERSMAN: Okay. Captain Martini, you talked about, in your 20 years as a pilot, you really didn't ever remember kind of talking about, with other crew members, about icing in terms of SLD. Am I capturing that thought correctly?

CAPT. MARTINI: Yes.

CHAIRMAN HERSMAN: What do you think pilots should know about SLD or SCDD that they don't now?

CAPT. MARTINI: What they should know about it. I guess what would they gain out of knowing what the acronym SLD is? They know and are trained to identify ice formations, rime ice, clear ice, and mixed ice, and the intensity of it, being a trace, light, moderate, or severe. You're talking in terms of areas that might be defined as possible SLD?

CHAIRMAN HERSMAN: Um-hum.

CAPT. MARTINI: That would mean that you could possibly get ice accretion or severe icing.

CHAIRMAN HERSMAN: For them to understand that that might be outside the certification envelope, that the aircraft might not be certified to perform in those types of conditions?

CAPT. MARTINI: Yes.

CHAIRMAN HERSMAN: Do you think that's important for pilots to know that?

CAPT. MARTINI: Oh definitely.

CHAIRMAN HERSMAN: And, you know, Dr. Kolly asked you about kind of this information and it's kind of struck me that dispatchers are probably the ones that are going to get this information on the front end, at least the forecast for freezing drizzle or freezing rain or, you know, the weather conditions and they might be more qualified to understand it. Would it be helpful to put a notice in the paperwork that's provided to the crew to kind of be aware of these conditions or to be cautious?

CAPT. MARTINI: Well, I agree. And our dispatchers, when they do go through the weather reports, if they find anything that stands out, typically they'll circle it so that when they fax the information to the crew, it catches their eye, too.

CHAIRMAN HERSMAN: Okay.

CAPT. MARTINI: And then, when they open the -- release, they can discuss the issues, icing letter, NOTAMs or whatever it may be.

CHAIRMAN HERSMAN: Do you think -- and Mr. Bonetto, you can chime in here too. Do you think that crew members are aware that the aircraft is not certified for all types of icing conditions, or do you think that they believe, as long as they're dispatched, they can go?

CAPT. BONETTO: I think they are, after our training.

CHAIRMAN HERSMAN: After your training?

CAPT. BONETTO: Yes, icing.

CHAIRMAN HERSMAN: Do they have to come to Toulouse?

CAPT. BONETTO: Yes, they do.

CHAIRMAN HERSMAN: Okay. And, Mr. Martini, how many of your pilots have gone to Toulouse for training?

CAPT. MARTINI: I've just been there to visit.

CHAIRMAN HERSMAN: Yes. Mr. Martini, Mr. Harris asked you a question about on approach, if you had a flap anomaly or stick shaker or a TAWS alert, what would you do? And your answer was to diagnose the problem and call for a checklist. My question to you is, when you're at 500 feet, you know, 1000 feet, do you want to be looking at a checklist or do you want your pilots to have a memory item when they get a stick shaker or a TAWS alert of something to do?

CAPT. MARTINI: I must not have heard the question correctly. If you get a TAWS alert, that's a given and you go around. A stick shaker, depending on the situation, in normal circumstances, no control malfunctions, anomalies, it's a given, it's a go-around. Those are memory items.

CHAIRMAN HERSMAN: Okay, thank you very much. Technical Panel, any additional questions?

CAPT. GUNTHER: Yes, Madam Chairman, I have one more question for Captain Bonetto.

Captain Bonetto, this is a commonsense thing that you mentioned to us when we were with you in Toulouse and then also when we were at Empire. When we asked you about, you know, someone had the discussion with you regarding freezing drizzle, freezing rain, do you fly into it? And your answer was why would you want to? And then you mentioned something about a cat. Could you repeat that for us?

CAPT. BONETTO: If you want. First of all, I would like to explain another thing. When we referred to a cumulonimbus situation, there is no information in the manufacturer or training manual which explain or which give the pilots the opportunity to fly in this condition. I think that the same case for severe icing condition. And as explained, it's not written on your wash machine that you don't have to put the cat in it.

CHAIRMAN HERSMAN: Is that clear enough for you, Captain Gunther?

CAPT. GUNTHER: I have no further questions.

(Laughter.)

CHAIRMAN HERSMAN: Okay. How about parties, do you have any additional questions? Yes, Mr. Harris.

MR. HARRIS: Thank you. I appreciate your analogy there, Captain Bonetto. I have a question for you, sir. You have flown the ATR 42 and 72 series aircraft with and without the APM, correct?

CAPT. BONETTO: Yes, correct.

MR. HARRIS: I'm going to give you a hypothetical situation, but to understand the function of the APM, I think it's worthwhile to consider. If you were flying an APM-equipped aircraft and you observed substantial ice accumulation on the unheated portions of the side windows, but the APM had not yet alerted, what actions would you take?

CAPT. BONETTO: First of all, we have to monitor external condition and external visual cues before using the APM. The APM will provide more information to the pilot in case of degradation in terms of performance, like speed or rate of climb. But the first thing we have to teach our pilot is to be aware on the external environment and all visual cues or tactile cues which can indicate that we are approaching severe icing condition.

MR. HARRIS: Thank you.

And, Inspector Sparrow, in the discussion of icing in simulators there was a lot of emphasis on handling and performance characteristics. But isn't it also correct that the simulator has to have the system functionality, i.e., the individual controls for the icing, anti-icing and deicing equipment and the icing indications? And for example, when those systems are used, when they're turned on, things like engine temperatures or parameters change and so on, indicating normal functioning of those systems for familiarization of crew member trainees.

MR. SPARROW: Yes, that's correct. I would like to expand upon an earlier answer. Severe icing in a simulator is subjective. We don't have real-time data for that. So it's just an increase in the degradation of the things that you just spoke about, which would give you, as we theoretical proceed, indications of severe icing, which vary aircraft to aircraft.

MR. HARRIS: And the purpose of the flight simulator is you qualify the device for its use by an air carrier or a Part 142 training center, is for use as a flight training device, correct? As a flight training, a piece of flight training equipment.

MR. SPARROW: Yes.

MR. HARRIS: And so the idea is to try to inculcate within crew members their knowledge of the aircraft systems and its operation. So, for example, if there were a malfunction of an anti-ice system, you could replicate that malfunction in the simulator and allow the crew an opportunity to execute a checklist associated with it, correct?

MR. SPARROW: Yes.

MR. HARRIS: Thank you.

And then for Captains Bonetto and Martini. In your recreation activity or the work that was done in Toulouse, involving the ATR simulator, what speeds did you attempt to maintain on approach during the recreation of the Lubbock arrival?

CAPT. BONETTO: The speed we have to maintain is red bug during the approach.

MR. HARRIS: So did you all intentionally fly the aircraft below red bug to replicate some of the flight data that was collected post-accident?

CAPT. BONETTO: Yes, we did intentionally to reach the threshold of the stick shaker. It was in terms of exercising, sure.

MR. HARRIS: And your subjective or observation of the handling characteristics of the aircraft during that time, were they consistent with what we saw in the earlier animation of the aircraft arrival into Lubbock, provided by the NTSB?

CAPT. BONETTO: Could you repeat your question?

MR. HARRIS: Yes, sir. Do you remember the animation that was shown earlier of the first day, of yesterday's hearing?

CAPT. BONETTO: Okay, it was pretty the same, yes.

MR. HARRIS: Thank you very much. No more questions, ma'am.

CHAIRMAN HERSMAN: Empire or ATR?

MR. FLANIGIN: No questions from ATR.

CHAIRMAN HERSMAN: We will adjourn for a recess. We will resume at about 3:35, about a 15-minute recess, for our last panel of FAA witnesses.

(Off the record.)

(On the record.)

CHAIRMAN HERSMAN: Welcome back. And we are going to conclude with our last panel, Witness Panel Number 4.

Mr. Broadwater, please call the witnesses.

MR. BROADWATER: Certainly.

Would Mr. Ostronic and Mr. Bond and Mr. Stimpson please return? Gentlemen, you can remain standing. If you'll raise your right hand, please.

(Witnesses sworn.)

MR. BROADWATER: Thank you. You may be seated. And we'll begin with Mr. Ostronic. If you could please tell us your full name, employer and your title for the record?

MR. OSTRONIC: Yes, my name is Jerry Ostronic. I'm an aviation safety inspector with the Federal Aviation Administration, based here in Washington with the Air Transportation Division. I am the focal point for ground and in-flight icing for flight standards.

MR. BOND: My name is Tom Bond, and I'm the chief scientist and technical advisor for aircraft icing. I work with all the directorates in the certification services and flight standards and called upon by any of the other business lines that need advice or --

CHAIRMAN HERSMAN: Could you pull your microphone a little closer?

MR. BOND: Excuse me. Repeat? My name is Tom Bond, I'm the chief scientist and technical advisor for aircraft icing, and I'm responsible for providing technical feedback regarding icing to all the certification service directorates and the flight standards and any other business lines that have questions.

MR. STIMPSON: Good afternoon. I'm Don Stimpson and I am an airplane performance and handling quality specialist for transport -- for the certification of transport category airplanes.

MR. BROADWATER: Thank you. You've not been promoted since earlier? The witnesses have been sworn in.

CHAIRMAN HERSMAN: And we'll go to the Technical Panel for the last round of questioning.

DR. BOWER: Thank you. We're going to start with Mr. Ostronic. I believe you have a presentation prepared, regarding icing requirements and guidance. If you could present that.

MR. OSTRONIC: Yes, I do. If you'd bring it up, I'd be glad to do that.

DR. BOWER: Certainly.

MR. OSTRONIC: As they bring it up, Madam Chairman, Board, and Panel, it's a pleasure to be here to actually provide this presentation and to answer any questions you may have after the presentation is over. As I said, my name's Jerry Ostronic. I'm with the FAA, and I have been for about 20 years. I serve as the focal point. I've also served as an airline captain and an instructor/pilot in an airline in major service in the Northeast United States and Central United States. Next slide, please.

I want to start by indicating some of the FAA actions to address icing-related and NTSB safety recommendations. There have been a total of 49 icing safety recommendations since 1994 that relates back to the Roselawn accident. Of those 49, 34 of those safety recommendations have been closed, 27 of them acceptable, three acceptable with alternate actions, two that exceeded the NTSB safety recommendations, one that was no longer applicable, and six that are unacceptable actions. Some of those have just been so old in response that basically they've expired. We have 15 open responses. Eight are planned with acceptable actions, one acceptable alternate actions, one awaiting additional information, and five that has planned unacceptable actions. This is in accordance with the NTSB classification of the current status of those recommendations. Next slide, please.

To give you some idea of what the FAA has done in response to safety recommendations, because I think that's important, I think sometimes the FAA's viewed as not being responsive, but I think, between the previous slide and this slide, I think we'll get an indication that we have been taking action.

For example, we have issued over 100 AD notes on over 50 airplane types, dealing with icing-related issues, to address NTSB safety recommendations. There's been two final rules have been issued. We've issued nine new or revised additional Advisor Circulars. There's been six safety alerts for flight operators that have been issued. We developed pilot training videos in cooperation with NASA. We've sponsored research into icing causes, effects and mitigations. And we're currently in the process of addressing several different rulemaking activities, one dealing with activation of ice protection equipment, one dealing with the certification for supercooled and liquid droplets, and another one to remove the authorization for -- next slide, please.

To get into some of the primary operational regulatory requirements dealing with icing, there are several other regulations that have fingers into it, but the next few slides will identify a few of the key ones. The base rule, if you will, is 91.9. It's the civil aircraft flight manual marking and placard requirement. And what it says, as an operator, about a pilot, must comply with the aircraft limitations established in the AFM, or if it's an airplane that doesn't have an AFM or has additional placards or markings, it requires the operator or pilot to comply with those stated placards and markings.

The next one is 121.141 and it addresses the airplane flight manual requirements, and what it says, that the operator must carry aboard the aircraft an AFM or manual approved by the FAA in accordance with 121 and 133. What 121 and 133 allows is an operator to develop their own manual, if you will, taking the extracted material out of the AFM and more tailoring it to their specific operation. 121.341 addresses equipment requirement for operation in icing conditions, and what it basically says, an aircraft in 121 service must meet the certification criteria of a transport category airplane, what we now know as Appendix C to Part 25. Next slide, please.

Other regulation, 121.629, is operations in icing conditions. This a multifaceted regulation. It has two key elements I want to address. The first element, it places the onus on the operator, determining at operations if icing conditions are expected or met that might adversely affect the safe operation of the flight. The second portion of the regulation is the regulation that requires an approved ground deicing program. 121.419 is pilot and flight engineer initial transition upgrade ground training.

There's a parallel recurrent and dispatcher training requirement. And it says that the training program must contain enough meteorology to ensure a practical knowledge of weather phenomenon, including the principles of frontal systems and icing and so forth. Appendix C to Part 121 is the flight training requirement. Once again it outlines the flight maneuvers and procedures, normal and abnormal and alternate operations, and it talks to the operation of the anti-icing and deicing equipment. Next slide, please.

Another piece of regulation, although not a regulation per se, but it's an operation specification. The operation specification is how the FAA tailors specific authorization or requirement for an operator. There's one operation specification that addresses icing, and it's Operation Specification A23, which is the operation specification used for the approval of an aircraft ground deicing program. It authorizes the use of the FAA holdover timetables for the use of de- and anti-icing fluids. Those holdover timetables do contain holdover times for takeoff in freezing drizzle and light freezing rain.

What Alpha 23 op spec is not, it is not an authorization for operations in freezing drizzle or freezing rain. An authorization for operations in freezing drizzle or freezing rain is contained in the limitation section of the AFM. Essentially, if it is not prohibited in the AFM, then the operation is through the AFM itself and the company procedures to operate in those conditions. Next slide, please.

In-flight icing guidance material that the FAA has developed in response to some of the NTSB safety recommendations. This is not all-inclusive, but it'll cover the primary ones. And pardon me, get to the slide. I had some notes on it. The first one is AC 91-74. The pilot guide to flight in icing conditions was published in December of 2007.

There was a predecessor to this, which was AC 91-74 without the alpha. It was published in 2005 in response to NTSB safety recommendations. There were some issues, that it didn't quite address the recommendation that the Board had made, and it was revised and republished as the alpha version of the AC in December of 2007. This AC covers the full spectrum, if you will, of the advisory material for flight in icing conditions. It talks to the certification criteria. It talks to the limitations of that certification criteria. It talks to icing equipment, SLD, particular recommendations for operations in different modes of operation, takeoff, landing, descent, holding, and so forth.

AC 91-54 Alpha, effects on aircraft icing, on aircraft control and airplane deicing and anti-icing systems, was published in July of 1996 after the Roselawn accident. It addresses the un-commanded roll and tailplane stall issues and guidance material and information on those conditions. SAFO 06016, in-flight icing, turbo-powered aircraft, published in 11 of '06.

It is a document that is for the identification of icing and severe icing, instructions to follow the AFM procedures for operation in those conditions, addresses the increasing -- recommendation for the increase of speed when operating in icing conditions, and the proper use of the autopilot in icing conditions. SAFO 08006, for Part 91 and 135, flights in known or forecasted icing conditions, published in January of '08. Once again it was targeted to address a safety recommendation made by the Board on the ambiguity of operations in severe icing that is in part of the regulation, of Part 91 and 135. Next slide, please.

InFO 090070, on pilot training and checking -- I'm not going to read the rest of the title. The title is a bit misleading. What it actually covers, it's a requirement to ensure that all pilots of pneumatic deicing boot-equipped airplanes understand and receive training on the proper operation of those systems and on maintaining an appropriate airspeed in icing conditions. It talks about the activation of boots at the first sign of ice accrual. It talks about the identification of severe icing. It talks about the increased speed when operating in icing conditions and talks about the training requirements associated with those operations. Next slide, please.

Notice 8900.55 is the FAA-approved deicing program guideline updates for the winter of 2008-2009. It was published in October of 2008. There's one published every year. It contains the new holdover times that are to be used for that winter season. There will be another one published, I don't know what the number will be, next month, in October of this year. It'll cover the 2009-2010 winter season. The FAA instrument flying handbook, the Notice 8900.1, which is the flight standards information management system. I think you've heard that referred to as the inspector guidance material, the Airman's Information Manual, Chapter 7. Next slide, please.

I want to talk a little bit about the airworthiness directives that have been issued. We've issued approximately 25 ADs, have been issued for aircraft activation of deicing systems in continuous mode at first sign of aircraft icing.

We've also issued approximately 40 ADs, issued for aircraft with pneumatic deicing boots and end power to aileron roll controls. The ATR 42 is one of those. And it calls for the visual cues for recognition of severe icing. It has a requirement for immediate exiting of icing conditions, if encountered. And it also has a prohibition of the use of the autopilot in severe icing conditions. Next slide, please.

I mentioned on one of the earlier slides some of the regulatory changes that have taken place and are in progress within the agency. Number one is Part 25 airplane performance and handling qualities certification requirement that, I believe, came out in August of '07. I think Mr. Stimpson mentioned that earlier. The second one is the activation, Part 25 activation of de- and anti-icing systems, which was published in August of 2009, was effective just this month, in September of 2009, and it deals with the ice detection equipment and the activation requirements.

There's a parallel rule to that rule that is in development within the FAA, dealing with the activation of de- and anti-icing systems for aircraft currently in service. As I said, that's in the process, regulatory process, right now. It has not yet been -- the NPRM has not yet been published. There's another 121 rule that's in development. It's the exiting icing conditions. That's in the early stages of regulatory development. Also, the Part 23 and 25 SLD aircraft certification requirements is in the development stage. Part 23 is in the very early stages of regulatory development. There also is the very early stages for Part 25 low-speed alerting system regulatory development process. Next slide, please.

As I said, my background is in operations, so I'm going to tiptoe a little outside of my specialty. I am not an aircraft certification engineer nor do I work for the transport directorate. But I think, to understand the rest of the slides, I need to lay a little foundation or at least talk about what the aircraft certification criteria is. And I have to underscore criteria and I know Don had spoken to that earlier and I think it's very important that we understand that. The certification criteria in Part 25, Appendix C, is just that, it's an evaluation criteria. It is not limitations.

It is not the limits of which the aircraft can operate. And that's an important thing that we have to understand. I think, as Don has indicated and I think Mr. Bond will mention in his presentation, that criteria covers about 99 percent of the icing conditions that are experienced in the environment. No matter where we would draw the line, we're probably never going to get a hundred percent of them, but we currently cover with Appendix C criteria about 99 percent of them, including some of that that falls within the SLD criteria. As I said, it is not a hard limit. We don't come up to the edge of the line at the certification criteria and any droplet size beyond that criteria, any encounter for a duration longer than the certification criteria, or any liquid water content greater than evaluate, doesn't take us to the end of the cliff that we fall off, that anything beyond that level is unsafe. It is just certification criteria.

I think the extensive successful aircraft operational history in conditions exceeding the established certification criteria, which we've heard freezing drizzle and freezing rain mentioned several times, substantiates the excessive capability of most aircraft beyond the evaluated intensities and exposure times for certification. The FAA and in some cases the manufacturer have imposed operational limitations that have been placed on aircraft evaluated or demonstrated limited icing capabilities beyond the certification criteria. We've heard in the last few days the Cessna 208 mentioned many times.

The reason the Cessna 208 is prohibited from operation in freezing rain and freezing drizzle is because the FAA issued an AD note restricting that based on the operational history of the aircraft. Some manufacturers have voluntarily restricted their aircraft from operation in freezing rain and freezing drizzle. Some of that has been based on revisions to Advisory Circulars talking about those type of environments. Two of those aircraft is the Eclipse and I believe, the Embraer 500, have voluntarily restricted the aircraft from those operations. Next slide, please.

Elements determining if freezing drizzle and/or freezing rain will produce severe aircraft icing. There are many of them. I think it's important first to say what freezing drizzle is. Freezing drizzle is a ground-based phenomena. It occurs when liquid precipitation strikes the ground and it freezes either on the ground or on a structure sitting on the ground. It is not unlike frost. I think we've all experienced the formation of frost at a time when the temperature is actually above freezing but the surface is below freezing.

Freezing drizzle can form in exactly the same fashion. You can have outside air temperatures that are above freezing but yet the surface temperature will be below freezing and the precipitation strikes that below-freezing surface and freezes. Meanwhile, the liquid within the atmosphere is a liquid. It is not a freezing condition.

So it's important to delineate that freezing drizzle or freezing rain being reported by an observer at an airport or being reported by an ASOS system at an airport does not necessarily mean that there is freezing rain or freezing drizzle in the atmosphere above the airport, nor does it mean that there is SLD conditions above the airport. They are not equal to each other. They are not synonymous. They are different events. According to the National Center for

Atmospheric Research, NCAR, freezing drizzle or freezing rain typically has a vertical development of less than 3,000 feet. It's a very shallow environment. In today's high-performance turbo-jet and turboprop aircraft, in most cases, that very shallow vertical development of freezing rain or freezing drizzle can be flown through in a very short period of time.

In order to get severe icing or even substantial icing, one of the key elements is how long is the aircraft exposed to that. Aircraft exposure time is a key ingredient to whether icing will be severe. As I said, the typical vertical development of freezing drizzle or freezing rain is less than 3,000 feet. With proper planning, the proper use of the procedures for the aircraft, and I think the historical evidence indicates that those areas can be transversed very safely with the proper procedures. Other things that affect whether a freezing drizzle/freezing rain environment will actually produce severe icing is the specific aerodynamic design of the aircraft.

We've talked a lot about the Cessna 208 in the last two days and I think that's evidence of an aircraft that doesn't have, or I shouldn't say doesn't have, it is an aircraft that produces ice very well. There are other aircraft that do not build up ice at the same rate as that aircraft. So not all aircraft and aerodynamic designs are the same as to the effect of a precipitation environment, whether it will form severe icing or not. I mentioned the outside air temperature. I'm not going to go there again. But total air temperature is another one. In most cases freezing drizzle occurs within four degrees -- minus four degrees C or above, between minus four and zero. There are some occasions where it does occur at colder temperatures, but typically minus four and above.

The aircraft operating through the air builds up -- it can build up an increased temperature due to the friction layer of the air striking the aircraft. So the aircraft skin can be at a temperature above freezing and can well fly through that environment without the precipitation freezing on the aircraft. The aircraft speed makes a difference. Obviously effects with the skin temperature can be. But it also affects the aerodynamic flow of the air over the surface of the airfoil and how those liquid water particles flow around it. Intensity of precipitation.

For example, light freezing drizzle that was reported the day of the accident site that we're talking about was -- the visibility was two miles. According to the Federal Meteorological Handbook, any drizzle or freezing drizzle that's being reported with visibility of one-half mile or greater is considered light. So the intensity of these freezing precipitations can be significantly different. Even if the aircraft were building up ice, obviously the ice accrual under a situation where you have half-mile visibility in freezing or light freezing drizzle versus what you would pick up in a 10-mile light freezing drizzle event would be significantly different. The size of the water droplets. I think Don had mentioned earlier that we talked about mean water droplet size when we do certification. There's a big gambit in the size of water droplets that actually fall into the category of freezing drizzle or freezing rain. There's a big spread.

Not all conditions of freezing rain or freezing drizzle are the same. And lastly, the effectiveness of the aircraft de- and anti-icing systems. I don't want to pick on the Cessna 208, but it's another example of an airplane that doesn't have that effective a deicing system, where other aircraft have far more effective deicing systems. Next slide, please.

(Slide.)

So, in summary, the FAA current position on operations in freezing drizzle and freezing rain. Based on the information I've discussed in the previous slides, including the current regulatory requirements, the guidance material, the airworthiness directives that have been issued, the current icing certification criteria, the proposed SLD regulations, and the variability of the conditions that affect freezing drizzle or freezing rain, along with -- will become severe icing, along with the extensive safe operational history in these conditions by the vast majority of aircraft currently in service, accompanied by the safety reviews and evaluations the FAA has conducted and continue to look at, along with the lack of compelling contrary data-supported information to the contrary, when aircraft are operating in accordance with the regulations, AFM limitations, including the airspeeds and so forth that are required for operations in icing conditions and current guidance material, the FAA cannot substantiate a need for a blanket operational prohibition for operations in freezing drizzle and freezing rain conditions. Next slide, please.

Once again, I thank you for the opportunity for the presentation, and Madam Chairman, I'll turn it back to you for questioning.

DR. BOWER: Thank you, Mr. Ostronic, for that very comprehensive presentation. I do have a few questions.

MR. OSTRONIC: Sure.

DR. BOWER: If we could pull up your Page 5. 121.629. See there, we have a statement that -- terminate operations if icing conditions are expected or met that might adversely affect the safety of flight. Could you expand on that a little bit in terms of what the terms expected or met are in that statement?

MR. OSTRONIC: Well, I think met is self-explanatory. If a flight crew encounters an icing condition that is beyond the capability of the icing equipment to deal with it, then they have to either alter course or if that's not possible, then they terminate the flight at the nearest airport that is suitable. Expected. If in the analysis of the dispatcher and the flight crew, that the flight cannot be completed, conducted safely, based on the review of the weather data and so forth, and from their analysis, for example, there is SIGMETs for severe icing and there's reports backing up those reports and it's at altitudes that they must operate because of terrain or whatever, then that would be expected conditions that would be outside the capability of the aircraft. But it's an analysis that has to be done on the individual information or the specific information that is available for that flight, through the evaluation of the dispatcher and the flight crew.

DR. BOWER: So how about a PIREP, would that meet that the criteria for expected?

MR. OSTRONIC: A PIREP is one of the ingredients that go into that. As you know, PIREPs -- as I talked about the different aircraft having different capabilities, along with that goes PIREPs, I mean, a PIREP from one airplane may not be something that's all that usable for a PIREP for the operation of a different make and model of aircraft.

DR. BOWER: And with the report of freezing rain or freezing drizzle at a destination airport be an expected?

MR. OSTRONIC: I would not say that's expected. I think there was -- on the first day of testimony, I think the captain said it's a heightened awareness. It would be something that is a heightened awareness and something that both the dispatcher and the flight crew have to evaluate, that phenomena.

DR. BOWER: And moving to your Page 10, where we described the 40 ADs. You mentioned the ATR 42, 72, were two of the aircraft included in those 40 airworthiness directives. Was the 208 included also? Do you recall?

MR. OSTRONIC: As I said, I'm not an airworthiness guy, but maybe Don can answer that. I'm not sure.

MR. STIMPSON: No, I don't recall if that particular airplane was included in that.

DR. BOWER: And within these ADs, the wording as listed, the prohibition of use of autopilot in severe icing conditions, why is that phrase included?

MR. OSTRONIC: Once again I'm speaking probably a little bit outside of my arena, but it had to do with the concern of the ice buildup and the potential on the forces on the ailerons and the potential for the lack of identification of that early in the flight regime. But maybe Don can expand upon that.

DR. BOWER: And within these ADs and these limitations that were included for all these aircraft, is it expected that the crew is required to determine if they are in the severe icing condition?

MR. OSTRONIC: One of the requirements was for the manufacturer of the aircraft to identify what those severe icing identification things are for that particular aircraft. I think that was pretty clearly articulated for the ATR 42. That was actually done through in-flight testing behind a tanker. Other aircraft had the option of doing that or a generic set of performance degradations and other things that would be associated with severe icing.

DR. BOWER: Each manufacturer had to determine the cues for their aircraft, which would determine for the flight crew when they're in severe icing?

MR. OSTRONIC: I believe that is correct. I think the FAA provided a generic set if they didn't want them to go out and do some evaluation. Once again I'll rely on Don to correct me if I'm wrong, but I believe the FAA, in the AD itself, provided kind of a generic set of cues or the manufacturer could go out and do an analysis and come up with their cues, and that's what the ATR company chose to do with the ATR 42.

DR. BOWER: And if we could move on to your last page. Not the questions page but the -- there we go.

MR. OSTRONIC: I like the question page better.

DR. BOWER: In the last bullet, you mention that it's expected that -- I'll make sure I got the right spot here. That is the last page, correct? I'll make sure I got the right one.

MR. OSTRONIC: There's the last page.

DR. BOWER: There we go. Your last bullet, where it mentions the lack of compelling data to support the information to the contrary. Does the FAA have any information on freezing rain/freezing drizzle encounters that have resulted in happy endings, so to speak?

MR. OSTRONIC: Say that again. Sorry.

DR. BOWER: Does the FAA have any data on freezing rain or freezing drizzle encounters where there was not a problem encountered by the flight crew?

MR. OSTRONIC: I can't point to any specific data that we have. I think when you look at the occurrences of ground-reported, through METARs or through an ASOS system, of freezing rain and freezing drizzle across the United States every year, I don't see us meeting in this forum very often. As a matter of fact, in my tenure with the FAA, I don't think we've ever had a meeting like this where we can point directly to a freezing drizzle or freezing rain event that is being reported on the surfaces as being an accident.

DR. BOWER: And also in the same bullet it says, When aircraft are operated in accordance with the regulations, AFM limitations, and current guidance material. Is it expected that the pilots always operated exactly by the AFM limitations?

MR. OSTRONIC: There's some things that you have to take as assumptions in any endeavor like this and we have to assume that the pilots operate the aircraft in accordance with the flight manual limitations. They operate at the appropriate airspeeds. They operate the aircraft in the appropriate configurations. They follow the flight manual limitations. If it has criteria to exit severe icing, that they exit that severe icing by the most expeditious method available to them.

DR. BOWER: Now in terms of the airspeeds that are determined and used, is there a particular margin typically included in those airspeeds?

MR. OSTRONIC: That's outside. Once again I'm going to turn to Don. Don might have better information for you than I do.

MR. STIMPSON: In terms of minimum airspeeds for icing conditions, yeah, it's typically the same margins that are applied in clean conditions to stall in icing conditions, for instance. So yes, they're not, for instance, right on the verge of stall warning on the verge of stall or what have you. There are margins included in those speeds.

DR. BOWER: Okay. And Don, as long as I still have you for discussion on stall margins, could you briefly describe the certification procedure testing that's performed to ensure that the stall warning provides an adequate margin in icing conditions?

MR. STIMPSON: Are you talking about under the current requirements of Amendment 121?

DR. BOWER: About under what the ATR 42 was certified to in its original license certification.

MR. STIMPSON: Right. Typically what was done at that time was to go down to either stall warning or to the stall and determine that you did receive a warning before the stall without a specific objective assessment of how big that warning was, that it was a subjective assessment of whether you had adequate warning before the stall. Under Amendment 121, the new requirements basically put in a specific requirement in terms of either a speed margin or a time margin in a given deceleration rate.

DR. BOWER: And in terms of the icing conditions, those are evaluated in?

MR. STIMPSON: In Appendix C icing conditions, right.

DR. BOWER: Appendix C. Was there any requirement that airplane manufacturers demonstrate that the margin is adequate in SLD?

MR. STIMPSON: Well, there's no defined standard for what constitutes SLD to know what the ice accretion would look like. That's one of the things that the rulemaking that's undergoing the rulemaking process now, with the -- expected next year, is expected to introduce that standard.

DR. BOWER: So if a stall warning margin determined from Appendix C icing testing of, say, seven percent, is there any guarantee that that same margin will exist if the airplane is operating in SLD or freezing rain or freezing drizzle?

MR. STIMPSON: No, you don't have objective data on what the ice accretion would look like for those, but you may get either a more critical or a less critical ice shape from the SLD conditions than you did under Appendix C.

DR. BOWER: So would that lead to a reduced stall warning margin?

MR. STIMPSON: Potentially.

DR. BOWER: So if we have a reduced stall warning margin below what is expected in icing conditions, wouldn't that -- would that constitute a reduction or removal of one safety feature included on the airplane?

MR. STIMPSON: It might constitute a reduction in the amount of safety margin you have. If you had no stall warning before stall, then you would remove one safety feature trying to keep you away from an inadvertent stall.

DR. BOWER: And so that reduction of stall warning or potential complete elimination of stall warning, it's something that can and possibly could occur in freezing rain and freezing drizzle or SLD, correct?

MR. STIMPSON: It could potentially occur if it resulted in a more severe ice shape for that particular airplane. Some of the airplanes we've looked at, it hasn't necessarily been the case, although we're still at the point of -- it depends on when you've looked at it to determine how you characterize that ice accretion under the SLD conditions, what the length of time was, what the water content was, and what the drop sizes were, where the impingement limits were.

DR. BOWER: And is there any information provided to flight crews regarding this exact phenomena in terms of the reduction of -- potential reduction of stall warning margin when operating in SLD?

MR. OSTRONIC: I think I can answer that. AC 91-74 and also the SAFO number, it escapes me right now, it talks about SLD, it talks about severe icing identification and it talks about increasing the airspeed any time you're in those sorts of environments. I don't have the exact number off the top of my head, but it's an increased percentage of the stall speed of the aircraft for that configuration.

DR. BOWER: Thank you, that's all I have. Captain Gunther.

CAPT. GUNTHER: Mr. Ostronic, thank you. Just a couple questions for you. The 40 aircraft that you talked about before that were in the AD, that are up on your slide, those are all aircraft that have non-powered controls and are booted?

MR. OSTRONIC: I believe that is correct.

CAPT. GUNTHER: Okay. You were talking about the statements and limitation section and we've gone over -- ever since '94, with Roselawn and after this AD occurred, we've gone over a number of the limitation sections on the aircraft, specifically some of those 40 aircraft. Most of them have statements such as flight in freezing rain, freezing drizzle or mixed icing conditions, supercooled liquid water and ice crystals, may result in ice buildup on protected surfaces, exceeding the capability of the ice protection system. That's kind of a blanket statement that's required by the AD, isn't it?

MR. OSTRONIC: That's correct, there's a may statement, yes.

CAPT. GUNTHER: Okay.

MR. OSTRONIC: It's a cautionary statement.

CAPT. GUNTHER: Okay. It's may. Okay. So what's the FAA's reasoning on not being proactive in limiting the aircraft out of those? The reason I'm asking you is you presented a lot of information here that I'm looking at and it's very -- I don't want to say sunshiny, okay, but one of the things is it says that it does not cover or does not require a blanket prohibition. Those 40 aircraft that are there, many of them don't have either bi-stall systems, they have un-boosted controls, they have boots, and they're operating in these conditions.

And part of the thing that we keep asking about is there is no -- as far as I can tell and you might be able to correct this, there's nobody at the FAA that's passing this knowledge directly on to pilots. I hear about ACs, Advisory Circulars. Those aren't mandatory. Many times they're probably not distributed to the flight crews. So how do we ensure that the flight crews are aware of these situations? They won't inadvertently encounter them other than having a prohibition put in place, okay, and that if they do encounter them, if they have the knowledge necessary in order to be able to deal with it.

MR. OSTRONIC: There's a lot of questions in your statement there and I'll try to dissect them and answer them one at a time. AC 91-74, I think, clearly addresses many of your concerns. The SAFOs that we talked about, about identification of severe icing that is typically or can be associated -- I don't want to say typically, but can be associated with SLD encounters, the identification of those and the proper procedures to fly if those were encountered, the current guidance about exiting severe icing immediately, I think cover the pilot informational purposes. When we publish ACs and we publish SAFOs, they go out to the different operators as well as to the field offices.

They are supplied to the operators for dissemination within their company by the system that the company finds most appropriate, whether that be winter operations bulletins or through a computer-based training system or whatever the operator finds the appropriate methodology. The evaluation or the opinion to the FAA with the ADs that we have taken on those booted, non-powered, aileron-controlled aircraft is appropriate. The ADs restrict operations in severe icing and to exit immediately. The identification clues when you do run into those conditions. We feel that we have appropriately addressed the risk for those aircraft.

CAPT. GUNTHER: So if a pilot actually flies into these conditions, there is an exit strategy, which we understand. One of my questions is, though, why -- for instance, you talked about approved ground deicing programs. That doesn't necessarily mean that the aircraft can depart in either freezing drizzle or freezing rain conditions. If an aircraft's in cruise and they go to destination and you have reported freezing drizzle, which to my understanding is 50 microns to 500 microns, all right, and the aircraft goes into those conditions, they may end up having a problem.

MR. OSTRONIC: I think the dots that you're connecting, Captain Gunther, is that a freezing drizzle report on the surface a METARs or an ASOS system is a direct correlation that there is freezing precipitation in the environment around the airport. That is not a direct correlation that we can draw, nor, if there were some freezing precipitation, to say that it is SLD or exceeds the capabilities of the aircraft to deal with that for a brief encounter, that is typically associated with freezing drizzle environments, it's not a direct correlation.

CAPT. GUNTHER: Now let me ask you a question also then. I'm not being facetious here, mind you. At the FAA, do you have anybody that is appointed, that is, other advisory information, that makes sure that training materials or training information about this actually gets to the end user, which is the flight crews and the people that are actually flying the aircraft? Because what I hear with ACs and SAFOs, et cetera, these are advisory in nature only.

MR. OSTRONIC: That is correct, they're advisory documents. The important thing to understand, that the primary responsibility to disseminate safety information within the company, a 121 organization, rests with the company management, typically with the director of safety within that company. Our POIs are charged with the oversight of those carriers to assess that that information is distributed within the company. But the responsibility for that dissemination rests with the director of safety within a 121 organization. They should have, and especially under the ATOS system, they have established procedures that address how that information is disseminated within the company.

CAPT. GUNTHER: And Jerry, thank you. I don't have any other questions. Thanks.

DR. BOWER: Thank you very much.

We're going to move on to Mr. Bond. And you're going to discuss the proposal for expanding the Appendix C icing envelope. Before you begin your presentation, Mr. Bond, could you quickly describe your experience before you came to the FAA?

MR. BOND: Yes. I came to the FAA about two and a half years ago. Prior to that I worked for 24 years at NASA, at NASA Glenn Research Center, prior, NASA Lewis. And out of those years, 21 of them I spent in icing research and the last 10 years I was the manager of the icing branch. My history there is mostly in experimental work, although I did work as a flight test engineer when I began my career and did tunnel testing.

DR. BOWER: Thank you very much. Your experience is quite extensive, and I want to make sure that the audience is well aware of that. You can proceed with your presentation. Thanks.

MR. BOND: Okay. Can you bring it up? All right, I'm going to talk about the proposed expanded icing envelope and the history of how this has brought to bear. I'm going to begin -- next slide, please.

I'm going to begin with just citing Appendix C, which is historically what we've used for certification since 1955. The details of this, I won't spend a lot of time on it, but the envelopes -- it's noteworthy that the envelopes were developed through a series of atmospheric flight tests over about an eight or nine-year period, and the data was collected. It was turned into a set of engineering standards, which is what you see there, for both continuous maximum conditions, which is the strata-formed clouds, and intermittent max, which is the next slide. And thank you.

In both of these conditions, even the envelopes show 40 microns for continuous and 50 micron size for the intermittent conditions, when the envelopes are used as an engineering standard for certification, the basis of that work, which is through 20-73A, the Advisory Circular, there's a droplet distribution spectra that is brought to bear along with the liquid water content and this actually -- the droplet distribution, with a -- distribution, actually do bring some of the lower bound of the freezing drizzle regime into the analysis that is done by any applicant that comes in for a certification. Those numbers are around 110 microns. So there are cases where, both in icing tunnel testing and in analysis with computational tools and other means, a small portion of larger droplets are looked at in the Appendix C envelope. Next slide, please.

The envelopes have been used routinely and with great effectiveness over a long period of time. Both Parts 25 and 23 operate safely in the icing conditions defined by these, and as has been stated earlier, it's 99 percent of the icing conditions. However, after the 1994 ATR 72 accident in Roselawn, the ARAC, Aviation Rulemaking Advisory Committee, formed, through a set of terms of reference, the Ice Protection Harmonization Working Group. They received tasking from the NTSB recommendations from the Roselawn accident and part of that task, which was Task 2, was to define an icing envelope that includes supercooled large droplets.

The ARAC received the -- reviewed the available data for SLD conditions when it was first started and it was determined that further atmospheric characterization and analysis was needed. Research was initiated to collect and analyze the data and this research began just prior to the formation of the Harmonization Working Group in about 1997 and it continued for a number of years. The Ice Protection Harmonization Working Group formed a meteorology subgroup, which was formed to evaluate the results of the atmospheric characterization and develop a set of icing envelopes that could be used to represent SLD conditions. When that was done, it was brought back to the Harmonization Working Group, which reviewed and developed a consensus position on the SLD envelopes. Next slide, please.

In terms of a timeline, the Ice Protection Harmonization Working Group was tasked and started in 1998. The actual delivery of the envelopes and the rest of the recommendations for Part 23 and Part 33 SLD mixed phase and ice crystal, including the envelopes that you've seen there, called Appendix X, were submitted to ARAC. Upon that submittal, the information was reviewed by TAEIG, the Transport Aircraft and Engines Issues Group, and upon that review, there was a request to go back and look at the Appendix X, both the draft rulemaking that were recommendations that were put forward and the envelopes, to determine if the means of compliance existed to go forward with the new rule.

That was brought back and over -- it took approximately two years to complete the analysis through the Harmonization Working Group. That was done in the first quarter of -- excuse me. It was done in 2009. And there is now -- it's now back within the FAA with a target for an NPRM for SLD new rules, including the information that I'll show a little later, for under consideration for an NPRM to be delivered in the first quarter of 2010. I'd like to point out -- and Jerry, I thought, did a nice of job in terms of his explanations that during the period of time that the ARAC was working on the SLD activities, that the FAA still worked on a set of key actions to continue to look at safe operations, including the amendment to amend regulations to address new designs, which is the ARAC process I've spoken towards, and address safety of the current fleet by airworthiness directives, conduct research for future enhancements and a significant amount of research was done since 1999 on SLD, both in terms of improving means of compliance capabilities and engineering tools and understanding its effects on the aerodynamics associated with the ice shapes generated on it, and to continue to monitor the operational safety. I've listed a set of the outcomes of some of that work, but Jerry's talked through them extensively, so I'll just move on to the next slide.

What I'm going to do is present a set of slides for what the expanded envelopes could look like based upon the Ice Protection Harmonization Working Group's recommendation to the FAA for consideration. And this information could be found in what's called the Task 2 Working Group Report, which is the terms of reference to explore this particular information, and it's located in a series of websites that are listed there that we won't go through, but you can find this information. And it's also been published in a series of technical journals, technical papers, by both the FAA and other atmospheric scientists involved in the original characterization of the envelopes. Next slide, please.

The structure of an expanded envelope that would complement the current Appendix C, it was determined by the Ice Protection Harmonization Working Group that they wanted to maintain the structure and analogous content to what was done with Appendix C because of the heritage of Appendix C for the existing fleet of aircraft and because it looked like a manageable way to show the data and represent its conditions.

And so there's a series of envelopes that are shown here, broken up into two separate functions in freezing precip. One is freezing drizzle and the other is freezing rain. The freezing drizzle conditions shown here, you can see the basis of liquid water content versus temperature in temperature altitude environments similar to what you'd see for Appendix C. This is the associated conditions for the freezing drizzle. Next slide, please.

And then there are two conditions for cumulative mass structure for freezing drizzle conditions. The freezing drizzle is identified in the Harmonization Working Group recommendation. It's 100 microns to 500 microns. Freezing rain is 500 micros and greater. The two conditions there show a set of bimodal envelopes that present a particular set of challenges in terms of the means of compliance and that took some time for that evaluation to take place to make sure there were engineering tools available if the rules were to go forward. The freezing drizzle is broken up into less -- MVDs of less than 40 microns and MVDs of greater than 40 microns, with the tails out above that 40 micron being the substantive changes in terms of the potential impact you'd have on aircraft surfaces. Next slide, please.

In regards to the freezing rain, both, again, the liquid water content against ambient temperature and pressure altitude, it's a much smaller envelope of conditions associated with freezing rain. The details within the Task 2 Working Group go into more extensive explanations of the envelopes than we have time to cover today. Next slide, please.

And the SLD freezing rain is also broken up, because of its bimodal conditions, into droplet size less than 40 microns and droplet size greater. This particular portion of the work gave a clear indication that in the current engineering capabilities, that freezing rain is a real challenge for acceptable means of compliance. And a final view graph.

Analogous to the Appendix C conditions -- could you move on to Number 11, please? Analogous to the Appendix C conditions there's a horizontal extent function, which accounts for the liquid water content and exposure time. There's one horizontal extent function that is a little different than the Appendix C intermittent max and continuous max. Both have a separate horizontal extent. That's it. Questions?

DR. BOWER: Thank you, Mr. Bond, for that extensive presentation, and I'm sure, if you wanted to, you could've made that presentation five hours long.

MR. BOND: If you'd like me to spend the rest of the time with the group here, I could do that.

DR. BOWER: I think you and I would be the only ones who would enjoy that.

MR. BOND: Sometime later, Dr. Bower.

DR. BOWER: Going back to the Appendix C, you said that's been around since 1955?

MR. BOND: I believe that's when it went into the rule, in terms of a regulation. The actual data was collected in the late '40s and early '50s.

DR. BOWER: And that experience has shown that, at least up to '94, it was the contention that 99 percent of the icing conditions were contained in Appendix C, that a flight crew would be expected to encounter?

MR. BOND: Yes. And the service records reflected a conservatism using Appendix C until conditions showed differently from new certifications.

DR. BOWER: And you said the ARAC determined that further atmospheric characterization and analysis was required. In the course of the research performed through either other research agencies or at NASA, was there any determination that SLD might be out there a little bit more prevalent than previously thought?

MR. BOND: I'm not sure how to answer that question. The discussions that took place in the -- within the Harmonization Working Group and then with the atmospheric scientists, they're actually cataloged in both a meteorology report by the FAA tech center within the Task 2 Working Group Report. There are different sets of positions and there was a majority and a minority position. The extent of that is that there are some people that believed that SLD is more extensive than was considered in the past.

The argument that proved hard to come to some closure on is that all the atmospheric research that's done is inherently biased towards trying to collect the information you're looking for. And so the frequency of the currents generated by the data that was brought out from that showed a higher preponderance than people had suspected from routine atmospheric sampling. So I don't know that I can give you a good answer, but there is a belief within the scientific community that it's more frequent than had been earlier thought of.

DR. BOWER: Thank you. Is this proposed Appendix X going to be a supplement to Appendix C or a replacement?

MR. BOND: It's been put in as a recommendation to be a supplement to Appendix C. The FAA is in deliberation to make those determinations at this point. When the NPRM comes out, the final deliberation will be shown.

DR. BOWER: And since the NPRM is still in preparation, you might not be able to answer that. But is it anticipated that all of these envelopes, Appendix C and the four flavors of the Appendix X, will have to be examined in future certification?

MR. BOND: I don't think I can answer that at this point. The consideration put forward by the ARAC group is that all of those envelopes and Appendix C should be included in the regulations for icing certification.

DR. BOWER: And you showed some distributions. They're called cumulative mass distributions for the proposals. And how were those mass distributions determined by the ARAC?

MR. BOND: The actual distributions were based upon a significant number, almost 400 hours, of atmospheric characterization flight work that looked at the content of and the properties associated with parsing the atmosphere into both large droplet freezing drizzle conditions and freezing rain conditions that were encountered. The cumulative mass distribution was first explored by a Boeing individual named O'Neill Shaw and presented in a set of papers in 2000 and brought to the meteorology subgroup and there was a series of conversations about how to best represent the conditions in the cumulative mass, was felt to be the best way to cover the envelope structure.

DR. BOWER: So is that sort of a replacement to the distributions used within the Appendix C?

MR. BOND: Yes. The strategy was that because of the nature of the properties associated with those particular clouds, the cumulative mass format was a better way to represent what those conditions are.

DR. BOWER: Thank you. I know we've been waiting for this NPRM for many, many years. I'll be looking forward to it.

MR. BOND: Me too.

DR. BOWER: That's all the questions I have. We're completed.

CHAIRMAN HERSMAN: Okay. No more Tech Panel questions?

DR. BOWER: That's correct.

CHAIRMAN HERSMAN: Empire.

MR. MILLS: No, ma'am, thank you.

CHAIRMAN HERSMAN: ATR.

MR. FLANIGIN: No, ma'am, no questions here.

CHAIRMAN HERSMAN: FAA.

MR. HARRIS: Yes, ma'am, and I promise to be brief.

Mr. Bond, does the current Appendix C envelope include some portion of the freezing drizzle phenomena?

MR. BOND: Technically, when you see the envelopes as shown in the presentation I put forward, they stop at 40 microns and 50 microns, but their use in application for regulations do include a portion of the freezing drizzle conditions associated with the new recommendation supplied, based upon the distributions that are used by the type applicant.

MR. HARRIS: And the second question is can severe icing occur without supercooled liquid droplets?

MR. BOND: Is that directed to me?

MR. HARRIS: Yes, sir.

MR. BOND: Yeah. Yes, severe icing, by its definition, has to do with the ability of the ice protection system to adequately perform, and there are conditions that you could run into that are not SLD, that could overwhelm an ice protection system.

MR. HARRIS: Earlier Mr. Ostronic pointed out that, in his testimony, freezing drizzle and freezing rain were not directly correlated or related to severe icing. Is that an opinion that you would share or you would like to comment on?

MR. BOND: I believe that the freezing drizzle conditions aloft, there are cases where they aren't directly related to -- did you ask for severe icing? Excuse me, I lost --

MR. HARRIS: Yes, for severe icing.

MR. BOND: For severe icing, freezing rain, I don't know that I hold the same opinion.

MR. HARRIS: And I may not have referenced it appropriately, so I would stand corrected on that. And again Mr. Ostronic, I believe, made a statement that surface observation of freezing drizzle or freezing rain did not have a direct -- did not provide direct information on the existence of SLD aloft at any particular altitude. So do you again have a comment on that?

MR. BOND: I support the observation that the surface information that's generated around terminal areas can be different than what's found aloft.

MR. HARRIS: One of the aspects of icing that is particular troubling, I think, for most pilots is the ability to remotely sense the presence of icing. We have some hazards to aviation, such as thunderstorms, low-level wind sheer, that we have developed abilities to detect remotely without having to physically be in that location to identify it. Can you comment on the ability or inability to accurately identify icing conditions remotely by aviation weather or air traffic or other entities that pilots interface with?

MR. BOND: The current forecast tools that are available, both the ones that were spoken towards from the National Weather Service and the current icing potential that was spoken about, both have a capability to -- through algorithms and surface observations and other modeling techniques, have an ability to identify large-scale areas where icing exists, but they don't have the resolution capable for a tactical use by a pilot, in my opinion, to help them understand where they should or should not fly. And so the forecast tools that are available simply don't have the resolution and the confidence levels required to be used for mission planning other than in a large-scale operation and looking where you might not fly.

MR. HARRIS: Would that be particularly true in talking about gradations of icing conditions? I mean, like in an unprotected aircraft operating, for example, under Part 135, has a very strict set of limitations against flight in operating -- in icing conditions. But in an aircraft that's certificated under Part 25, that's qualified for flight in icing conditions but might encounter a condition which is beyond its capability, does this inability or lack of specificity in the forecasting cause some underlying difficulties in that environment that we might not find in a more bindery environment where an aircraft is certainly not qualified for flight in icing conditions?

MR. BOND: The way I'd respond to that is that I think both the dynamic nature of the environment and the abilities to accurately represent what the level of intensity of the icing is, are simply not available to make a decision as to whether or not when you depart you're going to run into something that's more severe than you anticipated or that there is ice or not ice there with a 100 percent confidence level. That doesn't give the pilot enough guidance to make a good decision necessarily on that departure, in terms of a level of severity and whether or not they're going to run into a hazardous condition.

MR. HARRIS: Do you believe that that puts additional onus on the ability to identify icing conditions in flight and recognize when those start to become severe?

MR. BOND: I think it becomes incumbent upon the actual flight mission and the pilot to manage those, any mitigating threats against the level of icing and what it might have, based upon a specific configuration of the airplane.

MR. HARRIS: Thank you, sir. Mr. Ostronic, there was some discussion about disseminating information to the end user, the pilot and dispatcher, relative to the materials that the FAA has put out about flight in icing conditions, particularly referencing such things as Advisory Circulars and SAFOs. Are those documents used by POIs in reviewing or evaluating training programs and operational programs of Part 121 and 135 carriers?

MR. OSTRONIC: That is correct, they are.

MR. HARRIS: So, in fact, the absence of some information contained in one of those documents might be cause for the POI to go back to the operator and look for resolution?

MR. OSTRONIC: Yes, sir, that is correct.

MR. HARRIS: In the case of the airworthiness directive issued involving the ATR 42, which include information and guidance related to freezing drizzle and freezing rain, a discussion of the severe icing indications, the requirement to exit severe icing upon encountering, and the prohibition against using the autopilot in icing conditions, that was reflected in the airplane flight manual, correct?

MR. OSTRONIC: That's correct, that's in the limitation section of the flight manual.

MR. HARRIS: Is the airplane flight manual a fundamental document upon which pilot and dispatcher training programs are developed?

MR. OSTRONIC: That is correct.

MR. HARRIS: Is it also the fundamental document that the airplane flight manual or company flight manual used by the carrier in flight operations and dispatch is based upon?

MR. OSTRONIC: Well, I think in my presentation, C.F.R. 91.9 requires that that be complied with.

MR. HARRIS: And it would also be a fundamental document in something like a QRH, a quick reference handbook?

MR. OSTRONIC: That is correct, sir.

MR. HARRIS: So effectively, do you believe that the information contained in the airworthiness directive concerning the information on freezing drizzle and freezing rain, the identification of severe icing and the requirement to exit severe icing and the prohibition against the use of an autopilot in severe icing was transmitted to users?

MR. OSTRONIC: It definitely was. It's in the AFM. That's required to be on board the aircraft.

MR. HARRIS: And again, is the basic document for the training and operational documents used by the carrier?

MR. OSTRONIC: That is correct, sir.

MR. HARRIS: Thank you very much. Thank you very much, Madam Chairman.

CHAIRMAN HERSMAN: Mr. Haueter.

MR. HAUETER: Just a couple of questions to the Panel in general. I'm very pleased to see you're working on an SLD standard. I assume that once the standard is developed, that'll be applied to all new designs, but I'm curious, do you believe you're going to go back and reevaluate existing aircraft?

MR. STIMPSON: All I can speak to is the recommendation from the ARAC working group at this point, and the recommendation was to establish a Part 25 standard, which would apply to new certifications and not be applied retroactively to airplanes currently in service. In addition to that, I can comment that the FAA, in essence, we have a safety recommendation from the Board to go back and apply, once we finish all of our new standards that would apply to new airplanes, that we go back and retroactively apply that to existing airplanes.

And our response to that has been that we think that we have addressed the current fleet. We wanted to do that before we had the new standards, because we had some immediate safety problems. And we think the actions we've taken to date with the airworthiness directives, the InFOs, SAFOs and completion of the ACs have addressed the existing fleet.

MR. HAUETER: And also I may have missed it. What are your plans to train pilots in the future with the new standard, that once they're flying the aircraft, many pilots just don't understand what SLD is or what it's going to look like.

MR. OSTRONIC: I think the best way to address that is I don't feel a pilot needs to know SLD. He needs to be able to identify severe icing conditions that are often associated with SLD. But he doesn't really need nor is there the technology today to detect SLD per se. The pilot needs to know and I think the guidance material we've published to this point and have required through AD for some of those aircraft, specifies what actions are to be taken if they encounter severe icing. Whether severe icing encountered as part of an SLD event or severe icing is encountered outside of SLD, the recommended actions to escape that, immediately exit that environment, is guidance no matter whether it's SLD or created by some other atmospheric event.

MR. HAUETER: Thank you.

CHAIRMAN HERSMAN: Dr. Kolly.

DR. KOLLY: Just a couple quick questions. I heard it mentioned that if there's freezing rain or freezing drizzle reported on the ground, that that doesn't necessarily mean it's aloft; is that correct?

MR. OSTRONIC: That is correct.

DR. KOLLY: So is it not prudent, though, to assume so if you're talking about just from a safety point of view? You're indicating that this might be a very rare condition. Why wouldn't you -- if you have some indication, there's some level of correlation there because there's precipitation. Why wouldn't it be a prudent thing to do?

MR. OSTRONIC: Well, there's probably a higher probability. Admittedly there's a higher probability when you have those conditions. And I think, as the captain indicated yesterday, it's an increased level of awareness and a requirement to implement all the normal procedures you would for an icing encounter. As I indicated, typically a freezing drizzle environment/freezing rain environment is a very narrow vertical expanse.

The exposure time is very typically very short and in most cases well within the capabilities of the aircraft, under Appendix C, for those brief encounters. So when you say wouldn't you want to consider that, you absolutely want to consider it and you want to have an alternative plan, an escape maneuver, in your hip pocket. But it doesn't necessarily, I'll repeat, it doesn't necessarily mean that you're going to encounter any ice, or if you do encounter ice, that it's going to be to the level of severe icing beyond the capability of the aircraft systems to deal with it.

DR. KOLLY: Mr. Bond, do you have anything you'd like to comment on within that regards?

MR. BOND: No, no, I don't.

DR. KOLLY: Okay. And I think the question was asked by the FAA in a slightly different manner. I'm trying to understand. Can you experience severe icing conditions in Appendix C? I think the question was can you experience them outside of SLD? But I'm kind of flipping it around. Can you experience severe icing in Appendix C?

MR. BOND: Is this directed to me?

DR. KOLLY: Yes.

MR. BOND: Yeah, the way that you frame what severe icing is by definition, you could run into an intermittent max condition. As an example, with extremely high liquid water content, even if it was supposed to be for a short duration period of time, that might overwhelm the ice protection system. That would be considered a severe icing event.

CHAIRMAN HERSMAN: Mr. Ostronic, you mentioned that it wasn't really critical for folks to identify SLD but more to identify severe icing conditions. And just how do they do that?

MR. OSTRONIC: For those aircraft that have been identified to be very critical in icing conditions, if you would, that was one of the purposes of the AD that was issued for those, what is it, 40 airplanes or so, those booted aircraft with un-powered roll controls. One of the requirements of that AD was for the identification of severe icing on the aircraft, which, in the case of the ATR 42, we've heard numerous talk about the side window icing and the icing on unprotected surfaces and the icing on the propeller spinner. So for those airplanes that the AD has been addressed to, that's the identification method. For the other aircraft it's by definition that it's an accrual rate of which the deicing system cannot keep up with. That's the terminology that's used.

CHAIRMAN HERSMAN: Okay. So that sounds like, though, it's more of a reactionary thing. Once you've got in it, you've got to realize you're in it and get out, right?

MR. OSTRONIC: That's correct.

CHAIRMAN HERSMAN: I think, though, one of the things that we've been trying to understand for some time is, you know, maybe if they're not being attentive or if they've got something else going on in the cockpit, are there other things that can help folks so they aren't in this situation? And it certainly seems to me that the FAA has invested a lot in weather services and trying to improve those weather services. And I'm looking back at our report on the Monroe Embraer event, and there's a discussion in there that talks about some of the work that the FAA is doing.

This was in the mid to late '90s that you're leveraging funds through the National Science Foundation, NCAR, NOAA, NASA, DoD, NWS. You provided funding for three major field validation experiments, winter icing and storm protection in the winters of '89-90, '92-93, '94-95. Planning is underway for a joint freezing drizzle program with NASA Lewis Research Center through the winter of '96-97, and another with field effort in '97 to '98. They talk about forecasting, you know, and program direction that they're focusing on to improve the ability of forecast in-flight icing, especially in the cases of freezing rain, freezing drizzle and SLD aloft. This is over 10 years ago. The efforts focused on learning how to incorporate a variety of data sources into the forecast process, including satellite observation profiles, NEXRAD, terminal doppler.

The goal is to produce hourly three-dimensional icing forecasts for aviation users, with at least one hour lead time with high accuracy. This is supposed to be for use by flight service specialists, pilots and other users. They talk about, in '96, January '96, the AWC issued the first ever forecast of freezing precipitation aloft, and I think my question is -- it goes on to talk about other FAA-sponsored research. What is the purpose of having all of this investment and trying to identify it if nobody uses it?

MR. OSTRONIC: I'll start and I think Mr. Bond could jump in there because he's probably more familiar with a large degree of that research that was done. But I think it's a very complex issue. I mean, it's a very difficult thing to identify. I mean, we could come up with generalities, that there's expectations and so forth, but it's a very difficult thing to predict where and what intensity of icing will be. Icing, as I tried to articulate in one of the slides, it's somewhat aircraft dependent. What is severe ice to one aircraft is light or moderate icing to another aircraft. So it's a very difficult thing to tie down. I think the product of the some that is the current CIP and FIP charts that we have. But I think if you -- I think we had an exhibit that we looked at and maybe it wasn't here, but I think we looked at a CIP chart, for example. It covers the day of this particular accident. And you look at the wide area that that CIP indicated that there would be SLD, there probably was some SLD in some areas in that wide area, but it would be, I think, a stretch to say that it was actually definitely SLD covering that entire scope that was identified within that CIP chart.

So there's been progress, but I don't believe the current technology is there yet where we can, with any sense of reliability, say that there is a certain level of icing or a certain level of liquid water droplets that will certainly be in a location or a certain altitude. I'll turn it over to Mr. Bond, who's probably far more familiar with the research that was done than I am.

MR. BOND: I think the research you spoke of, as a result of investments by the FAA and NASA at that time, along with NCAR and NOAA in this country and then Environment Canada in Canada, was the basis of the beginning of a much better understanding of how to parse this atmosphere continuum that has all kinds of icing in it, both Appendix C and large droplet exposures and ice crystals. And those conditions are very dynamic and they don't -- they can shift and change in any given short period of time with a cell extinction or formation based upon the autographic nature of the ground around it, the winds aloft and a lot of other feature characteristics. The way I'd respond in terms of the technology maturation is that, as Jerry had said, we've reached a stage with both the CIP and FIP that the CIP is now a supplemental product that's used by AWS or the National Weather Service, and it's reaching a stage of improvement that's continued investment through the FAA Aviation Weather Research Program, with a set of goals within the next three to four years to bring it to the level, resolution level, grid outputs that could be used with a higher level of accuracy and more confidence.

And it takes a long time to both do the developmental, numerical modeling, and then the validation exercises to prove its capabilities. And I think that we're significantly farther along in the forecast tools than we were when the accidents happened in the mid and late 1990s. But we have a ways to go before those improvements can be done to bring them into what I call a product use with a level of confidence.

CHAIRMAN HERSMAN: Well, and I think there's -- you know, there are certainly some challenges with forecasting, but in this situation we had a report of conditions as they were coming in and I know it's not unusual for aircraft to go through several different layers of icing. We saw it in Circuit City. We're seeing kind of a similar -- that's the Pueblo accident. But let's say we're not -- you know, kind of you all are not focused on the forecasting part of it. I'm still concerned. When people get into it, how do they know what they're into to get out of it? We certainly have problems with recognition and talking yesterday to First Officer Cornell, who was a very low-time pilot, I had asked her how many other times she'd been in icing or seen icing and she thought maybe once. And so what are they supposed to do as far as identification?

MR. OSTRONIC: Once again, in the particular airplane that we're talking about here, there's clear identification methods for severe icing in the AFM. It's in the limitation section of what constitutes severe icing that they need to extricate themselves from. As I indicated in the presentation, there was a new Part 25 rule that'll become effective this month, in September, that will address ice detection equipment requirements for future aircraft.

The FAA is in the process of developing a parallel rule for the aircraft that are currently in service that will be part of the 121 rule. So there is rulemaking activity underway. For Part 25 it's already completed. For Part 121, that will have a requirement for ice detection systems or alternate procedures in lieu of ice detection systems.

CHAIRMAN HERSMAN: Okay. Maybe we can turn to kind of a different area. We've made recommendations about expanding Appendix C. And so can you help me kind of understand what changes have been made? Is this the pending NPRM that's going to come out?

MR. BOND: Yes.

CHAIRMAN HERSMAN: Is this the first time there have been changes, expansion to Appendix C?

MR. BOND: I'm not sure I'm qualified to say that it's the first time, but this is a substantial increase through the recommendation from the ARAC of a set of conditions to the current Appendix C envelope.

CHAIRMAN HERSMAN: Well, what gives me concern as I look back at this history and I'm looking at an accident investigation report where you reference, in September 1981, the Board published a report entitled "Aircraft Icing Avoidance and Protection," and the report stated in part that icing criteria for aircraft certification is defined in 14 C.F.R. Part 25 are based on research done in the '50s, which I think you talked about, Mr. Bond.

And although the results of the research is still basically valid, there have been a lot of changes and the Board's report from '81 included a recommendation that FAA review the icing criteria in Part 25 and expand the Appendix C envelope. We're reiterating this in a report from the '90s. And then, you know, we subsequently went into this ARAC process and I look back at our recommendations on the ARAC process and you know, kind of hearing you describe it, it was constituted and put together over 10 years ago and we're still not even to the point where we have an NPRM. And so we have potentially scores or a generation of aircraft that have been certificated and are out there, and we don't even have a final rule. We were told that we would get an NPRM in 2003, you responded -- the FAA responded to the Safety Board's concerns, saying they would publish a notice of proposed rulemaking based on the ARAC's work by June 2004.

And now it sounds like maybe we'll get something in 2010, but that doesn't mean it's a final rule. We could be out there five more years before we see a final rule. And then how many more years to phase into the implementation? And so do we see another generation of aircraft that don't have this expanded protection? Do you have any confidence that we're going to get a final rule?

MR. BOND: I can't answer that question, parts of it. There is a typical pace after the NPRM comes out for final rulemaking, but there's no guarantee that that will happen once the NPRM is released for this. I do have a general comment and that is that I believe, in my experience, that until -- and I recognize that for a long time there's been SLD environment.

It's been known. It was known by the people who did the original research. If you look at the methods they used in that original research, you'd see that they had very, what I'd call, rudimentary or limited techniques to define what that environment looks like. The use in the 1950s was a rotating multi-cylinder. And back in the 1980s the FAA put a significant effort forward, including a collaboration with NASA, to reexamine the Appendix C envelopes and look at them with more modern optical, electrical instruments and new hotwire technologies. Even those instruments in that era couldn't detect the large droplet environments that we're looking at and we characterized started in about 1997. It took a long time to develop the kinds of measurement technologies to actually assign a confidence level to the kinds of measurements you were making in the environment.

That's not an excuse for not having a rule, but that's the technology measure that takes awhile to actually be able to implement and characterize what you're looking at. And I think we've reached a stage where we have a fairly high confidence level on the data that was put forward in the ARAC recommendations and hopefully that will be accepted and move forward.

CHAIRMAN HERSMAN: Well, I hope so. We made recommendations back in '97 following the Embraer, the Comair accident in Monroe, about disengaging the autopilot whenever anti-icing systems were activated, as manual flying can provide tactile cues to the airplane's handling characteristics. And then, from a series of Saab 340 accidents involving loss of control due to low airspeed and in-flight icing conditions, we issued recommendations concerning a requirement for all pilots of turboprop-driven airplanes to disengage the autopilot and fly the airplane manually. I thought I heard, in response to a question that Mr. Harris asked, that you said that there was sufficient information that the FAA had put out so that everyone understood that they weren't supposed to be flying in autopilot in icing conditions, or did I misunderstand the question and the answer?

MR. OSTRONIC: There's guidance material put out in AC 91-74 Alpha. There's also a SAFO -- the number escapes me right now -- that talks about the appropriate use of the autopilot. And it's not a prohibition of the use of the autopilot. It recommends, in other than severe icing conditions, that the autopilot be disconnected periodically and an assessment made of the controllability of the aircraft, and that in severe icing conditions that the autopilot be disconnected and the aircraft be hand-flown.

The AD that was issued on those aircraft with boots, pneumatic deicing boots and unpowered roll controls, supports that prohibition against severe icing. I think some of the statements that were -- that was made by the flight crew, I think, indicate some of the FAA's concern about a prohibition against using the autopilot in other than severe icing conditions.

For example, I think there were statements made about the workload that they encountered and the workload was classified as normal, until such time as the autopilot disconnected and then the workload was classified as much higher. And that is very similar to the FAA's concern over the prohibition, a blanket prohibition of using the autopilot in icing conditions. I think the guidance material that we have currently out there in the SAFO and in the Advisory Circular is appropriate for the proper use of the autopilot and for those aircraft that have demonstrated roll problems, if you will, because of unpowered controls and pneumatic deicing boots. We have gone forward with the AD note to prohibit the use of the autopilot in severe icing conditions.

CHAIRMAN HERSMAN: And do you have any sense of what the compliance rate is with the prohibition that you've put out?

MR. OSTRONIC: It's in the limitation section of the flight manual. They should be compliant with it. As far as a measurement of what the compliance level is, I don't have that.

CHAIRMAN HERSMAN: Well, I think one of the challenges that we've certainly seen -- and I can just comment more on reports that have come to the Board since I've been here. I looked back at the Circuit City report. They were on autopilot until it disconnected because they got themselves into a situation where they, you know, couldn't. Colgan, I look at that one. That autopilot disconnected too and they started getting, you know, into trouble.

And here we saw it in this accident. And they've got a handful of airplane once that autopilot disconnects and they weren't prepared for it. You know, I think the reason why our staff has made these recommendations is so that people can anticipate what's happening and recognize degradation over time. You don't want it to disconnect and then you're in a situation where the airplane still out of trim. You know, they're not managing it. So I continue to have concerns about information that's out there. I just don't think it's getting through the pilots.

MR. OSTRONIC: Yeah. If I may address that, and not to be argumentative, but I don't think in the accident we're looking at, nor my brief knowledge of the Colgan accident, that we're talking about autopilot-induced problems by icing. I think, yes, in both cases they had an airplane full -- a handful of airplane, but it was not because of an autopilot disconnect or any association to icing. It was apparently, at least from the evidence that's been presented, it had to do with getting in a low flight regime and a low airspeed where they had the stick shaker and in some cases a stick pusher activation. I understand your concern, but I'm not sure there's a direct relationship to the two accidents and the autopilot disconnect.

CHAIRMAN HERSMAN: Right. I think my point is more that we're just -- our recommendation is about not flying an autopilot in icing conditions. We are not limiting our focus to severe icing conditions, which I think that that's where you all are.

MR. OSTRONIC: Okay.

CHAIRMAN HERSMAN: Staff, do you have any -- Technical Panel, any additional questions?

(No response.)

CHAIRMAN HERSMAN: Parties?

(No response.)

CHAIRMAN HERSMAN: Very good. Thank you to the last witness panel. The last witnesses have been heard. We conclude this phase of the Safety Board's accident investigation. In closing, I'd like to reemphasize that this investigation remains open to receive at any time new and pertinent information concerning this accident. The Board may, at its discretion, reopen the hearing so that such information may be part of the public record. Some of you have information to provide for the record, commitments to get back to us with some answers, and so please provide that information to the hearing officer, Mr. Darrin Broadwater.

The Safety Board welcomes any comments from the parties or the public that may assist in our efforts to ensure the safe operation of commercial aircraft. Any recommendations should be sent to the Safety Board at 490 L'Enfant Plaza, Washington, D.C. 20594, within 30 days.

All the evidence developed in this investigation, in the hearing and all submissions received from the parties within the specified time will be evaluated in the deliberations of the Board. On behalf of the National Transportation Safety Board, I would like to again thank the parties for their cooperation, not only during this proceeding, but throughout the investigation. Also I'd like to express our appreciation to all of those witnesses who have given us their time and their expertise so willingly and maybe under duress at times throughout the hearing. The record of the investigation, including the transcript of the hearing and all of the exhibits that have been entered into the docket, will become a part of our record and that information is now available through our website on line. Anyone who wants to purchase a copy of the transcript, please contact Nick, who is the court reporter, directly.

I now declare this hearing in recess indefinitely.

(Whereupon, at 5:15 p.m., the hearing in the above-entitled matter was adjourned.)

CERTIFICATE

This is to certify that the attached proceeding before the

NATIONAL TRANSPORTATION SAFETY BOARD

IN THE MATTER OF:	EMPIRE AIRLINES FLIGHT 8284 OPERATING A FEDEX-OWNED ATR 42 (N902FX) WHICH CRASHED 300 FEET SHORT OF THRESHOLD ON INSTRUMENT APPROACH TO RUNWAY 17 LUBBOCK INTERNATIONAL AIRPORT LUBBOCK, TEXAS - JANUARY 27, 2009
DOCKET NUMBER:	SA-533
PLACE:	Washington, D.C.
DATE:	September 23, 2009

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.

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Dominico Quattrociocchi
Official Reporter