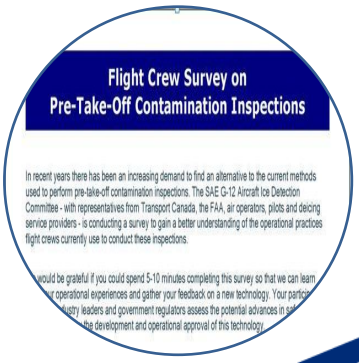
TP 15199E

Research to Assess the Need for Remote On-Ground Ice Detection Systems (ROGIDS) at End-of-Runway



Prepared for
Transportation Development Centre

In cooperation with

Civil Aviation
Transport Canada

and

The Federal Aviation Administration
William J. Hughes Technical Center

Prepared by:

APS Aviation Inc.

November 2012
Final Version 1.0

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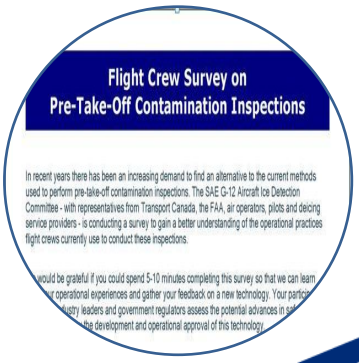

by:
Stephanie Bendickson

November 2012
Final Version 1.0

The contents of this report reflect the views of APS Aviation Inc. and not necessarily the official view or opinions of the Transportation Development Centre of Transport Canada.

The Transportation Development Centre does not endorse products or manufacturers. Trade or manufacturers' names appear in this report only because they are essential to its objectives.

DOCUMENT ORIGIN AND APPROVAL RECORD

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Un sommaire français se trouve avant la table des matières.

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PREFACE

Under contract to the Transportation Development Centre of Transport Canada with support from the Federal Aviation Administration, APS Aviation Inc. has undertaken a research program to advance aircraft ground de/anti-icing technology. The specific objectives of the APS Aviation Inc. test program are the following:

- To develop holdover time data for all newly-qualified de/anti-icing fluids and update and maintain the website for the holdover time guidelines;
- To evaluate weather data from previous winters that can have an impact on the format of the holdover time guidelines;
- To conduct tests to evaluate the effect of deployed flaps and slats prior to anti-icing;
- To conduct tests and research on surfaces treated with ice phobic products;
- To develop an SAE AIR for the evaluation of aircraft coatings;
- To support the evaluation of the National Research Council Canada propulsion icing wind tunnel to determine its flow characteristics;
- To evaluate the use of sensors in determining active frost conditions;
- To continue research for development of ice detection capabilities for pre-deicing, engine deicing and departing aircraft at the runway threshold;
- To update the regression coefficient report with the newly-qualified de/anti-icing fluids; and
- To evaluate if Type II/IV holdover times can be developed for light and very light snow categories.

The research activities of the program conducted on behalf of Transport Canada during the winter of 2011-12 are documented in six reports. The titles of the reports are as follows:

- TP 15198E Regression Coefficients and Equations Used to Develop the Winter 2012-13 Aircraft Ground Deicing Holdover Time Tables;
- TP 15199E Research to Assess the Need for Remote On-Ground Ice Detection Systems (ROGIDS) at End-of-Runway;
- TP 15200E Cold Climate Technologies – Investigation of Sensor Technologies as an Alternative Means of Detecting Aircraft Icing (Year 1 of 3);
- TP 15201E Winter Weather Impact on Holdover Time Table Format (1995-2012);
- TP 15202E Aircraft Ground Icing General Research Activities During the 2011-12 Winter; and
- TP 15203E Aircraft Ground De/Anti-Icing Fluid Holdover Time Development Program for the 2011-12 Winter.

In addition, the following three interim reports are being prepared:

- *Further Development of Ice Pellet Allowance Times: Characterization and Calibration of Wind Tunnel for Examining Anti-Icing Fluid Flow-Off Characteristics;*
- *Investigation of Ice Phobic Technologies to Reduce Aircraft Icing in Northern and Cold Climates; and*
- *Evaluation of Endurance Times on Extended Flaps and Slats.*

This report, TP 15199E has the following objective:

- To research, assess, and document the need for remote on-ground ice detection systems at the takeoff end of the runway to determine if resources should be allocated to supporting the development and use of remote on-ground ice detection systems for this application.

Two research projects were completed to achieve this objective: a survey of flight crews and an evaluation of incident reporting data.

PROGRAM ACKNOWLEDGEMENTS

This multi-year research program has been funded by Transport Canada with support from the Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ. This program could not have been accomplished without the participation of many organizations. APS Aviation Inc. would therefore like to thank the Transportation Development Centre of Transport Canada, the Federal Aviation Administration, National Research Council Canada, the Meteorological Service of Canada, and several fluid manufacturers.

APS Aviation Inc. would also like to acknowledge the dedication of the research team, whose performance was crucial to the acquisition of hard data. This includes the following people: Steven Baker, Stephanie Bendickson, Jeffrey Bourgerois, John D'Avirro, Jesse Dybka, Daniel Fata, Benjamin Guthrie, Dany Posteraro, Marco Ruggi, James Smyth, David Youssef and Victoria Zoitakis.

Special thanks are extended to Howard Posluns, Yvan Chabot, Doug Ingold and Warren Underwood, who on behalf of the Transportation Development Centre and the Federal Aviation Administration, have participated, contributed and provided guidance in the preparation of these documents.

PROJECT ACKNOWLEDGEMENTS

This project was made possible with the contributions, guidance, and support of Edward Pugacz (Federal Aviation Administration Technical Center), Doug Ingold (Transport Canada) and the SAE International G-12 Ice Detection Committee ROGIDS Working Group. Special thanks are given to the aircraft ground icing industry members who assisted in circulating the Flight Crew Survey (individuals and associations listed on page 6).

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15. Supplementary Notes (Funding programs, titles of related publications, etc.)

Several research reports for testing of de/anti-icing technologies were produced for previous winters on behalf of Transport Canada. These are available from the Transportation Development Centre. Several reports were produced as part of this winter's research program. Their subject matter is outlined in the preface. This project was co-sponsored by the Federal Aviation Administration.

16. Abstract

This report documents two research projects that were carried out to assess the need for remote on-ground ice detection systems (ROGIDS) to be located and used at the takeoff end of the runway in winter conditions.

- Flight Crew Survey: A survey of Canadian, American and international pilots was carried out to gather information from pilots on pre-takeoff contamination checks, to determine if pilots would accept / want a ROGIDS at the departure end of the runway and to gather anecdotal information on frequency of deicing-related turnbacks. 756 responses were received. The responses illustrated general support from pilots for ROGIDS use at the end of the runway. They also revealed that many pilots do not receive adequate training to identify fluid failure and that several obstacles prevent pilots from being able to conduct the needed contamination checks adequately.

- Analysis of Incident Reporting Data: Two incident reporting databases (CADORS and ASRS) were investigated with the objective of determining if ROGIDS could have prevented any reported incidents from occurring. One of the databases (CADORS) did not provide sufficient detail in each report to make this assessment. The ASRS database was filtered to select 42 relevant reports spanning a ten-year period. It was determined that a ROGIDS could have a significant impact on the number of aircraft ground icing safety incidents, especially if located at the departure end of the runway (which could likely have prevented half of the incidents reviewed).

As a result of the information gathered in these two research projects, it is recommended that resources be allocated to advance the use of ROGIDS technology for the end-of-runway application.

17. Key Words	18. Distribution Statement
Anti-icing, deicing, deicing fluid, ice detection, end-of-runway	Limited number of copies available from the Transportation Development Centre

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15. Remarques additionnelles (programmes de financement, titres de publications connexes, etc.)

Plusieurs rapports de recherche sur des essais de technologies de dégivrage et d'antigivrage ont été produits au cours des hivers précédents pour le compte de Transports Canada. Ils sont disponibles au Centre de développement des transports. De nombreux rapports ont été rédigés dans le cadre du programme de recherche de cet hiver. Leur objet apparaît à l'avant-propos. Ce projet était coparrainé par la Federal Aviation Administration.

16. Résumé

Le présent rapport documente deux projets de recherche visant à évaluer la nécessité d'installer et d'utiliser, dans des conditions hivernales, des systèmes de détection à distance du givrage au sol (*remote on-ground ice detection systems*, ou ROGIDS) en bout de piste de décollage.

- Sondage auprès des membres d'équipage : Une enquête a été menée auprès de pilotes canadiens, américains et internationaux pour obtenir des informations sur les inspections de contamination avant le décollage, pour déterminer s'ils accepteraient/souhaiteraient l'utilisation d'un ROGIDS à l'extrémité de départ d'une piste, et pour recueillir des informations accessoires sur la fréquence des retours pour dégivrage. Au total, 756 réponses ont été recueillies. Elles exprimaient le soutien général des pilotes à l'égard de l'utilisation de ROGIDS en bout de piste. Elles ont également révélé que de nombreux pilotes ne reçoivent pas de formation appropriée pour détecter la défaillance d'un liquide et que plusieurs obstacles empêchent les pilotes de mener adéquatement les vérifications de contamination requises.
- Analyse de données sur les comptes rendus d'événements : Deux bases de données (SCRQEAC et ASRS) ont été interrogées afin de déterminer si l'utilisation de ROGIDS aurait pu prévenir la survenue d'événements rapportés. L'une des bases de données (SCRQEAC) n'a pas fourni suffisamment de détail dans chaque rapport pour procéder à cette évaluation. La base de données de l'ASRS (*Aviation Safety Reporting System*) a été filtrée pour retenir 42 rapports pertinents couvrant une période de 10 ans. Il a été déterminé que l'utilisation d'un ROGIDS peut avoir d'importantes répercussions sur le nombre d'événements liés à la sécurité et au givrage au sol des aéronefs, en particulier s'il est situé à l'extrémité de départ d'une piste (la moitié des événements examinés auraient probablement pu être prévenus par un tel système).

À la lumière des informations recueillies dans le cadre de ces deux projets de recherche, il est recommandé que des ressources soient allouées afin de promouvoir le recours à la technologie des ROGIDS en bout de piste.

17. Mots clés	18. Diffusion
Antigivrage, dégivrage, liquide de dégivrage, détection de glace, bout de piste	Le Centre de développement des transports dispose d'un nombre limité d'exemplaires.

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EXECUTIVE SUMMARY

Remote on-ground ice detection systems (ROGIDS) have been in development for the aircraft ground icing industry for many years. A significant amount of research has been conducted with these systems to assess their performance, with varying results over the years.

A turning point was reached in the winter of 2004-05, when research demonstrated that in certain circumstances ROGIDS are more reliable than human visual and/or tactile checks in detecting clear ice on aircraft critical surfaces. An SAE working group was subsequently formed to develop an aerospace standard defining the minimum operational performance requirements for ROGIDS for this application. The standard was published by SAE in September 2007 and was followed by Transport Canada and Federal Aviation Administration Advisory Circulars in the years following.

Discussions in the working group about other potential applications for ROGIDS (end-of-runway, engine icing, and pre-deicing) determined the next focus should be the potential use of ROGIDS at the departure end of the runway. The working group determined that before operational research and new regulatory documents were considered, the need for ROGIDS at end-of-runway should be researched and documented.

Two research projects were completed to meet this objective: a survey of flight crews and an analysis of accident reporting databases. These research projects are documented in this report.

- Flight Crew Survey: A survey of Canadian, American, and international pilots was carried out to gather information on pre-takeoff contamination checks, to determine if pilots would accept / want a ROGIDS at the departure end of the runway, and to gather anecdotal information on the frequency of deicing-related turnbacks.
- Analysis of Incident Reporting Data: Two incident reporting databases (CADORS and ASRS) were investigated with the objective of determining if ROGIDS could have prevented any reported incidents from occurring. One of the databases (CADORS) did not provide sufficient detail to make this assessment, but 42 relevant reports were found in the ASRS database.

Both research projects illustrated that locating a ROGIDS at the departure end of the runway could have a significant positive impact on safety. As a result, it is recommended that resources be allocated to advance the use of ROGIDS technology for the end-of-runway application and that this work be conducted with the guidance and support of the ROGIDS working group.

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SOMMAIRE

Les systèmes de détection à distance du givrage au sol (*remote on-ground ice detection systems*, ou ROGIDS) sont mis au point pour l'industrie du dégivrage au sol des aéronefs depuis plusieurs années. Une quantité considérable d'essais ont été menés sur ces systèmes pour en évaluer la performance, et les résultats ont été variables au fil des ans.

Un moment charnière a été atteint durant l'hiver 2004-2005 lorsque les recherches ont démontré que dans certaines circonstances, les ROGIDS sont plus fiables que les vérifications tactiles ou visuelles par des humains pour détecter la présence de glace transparente sur les surfaces critiques d'un aéronef. Un groupe de travail de la SAE a par la suite été formé pour mettre au point des normes aérospatiales établissant les exigences de rendement minimal opérationnel pour les ROGIDS dans ce contexte. Dans les années qui ont suivi, des circulaires d'information émises par Transports Canada et la Federal Aviation Administration ont succédé à la publication de ces prescriptions par la SAE en septembre 2007.

Au terme de discussions au sein du groupe de travail au sujet d'autres applications potentielles pour les ROGIDS (bout de piste, givrage des réacteurs, et dégivrage préliminaire), il a été établi que la prochaine priorité serait celle de l'utilisation potentielle de ces systèmes à l'extrémité de départ d'une piste. Le groupe a déterminé qu'avant d'envisager la réalisation de recherche opérationnelle et de nouveaux documents réglementaires, la nécessité de l'utilisation des ROGIDS en bout de piste doit être étudiée et documentée.

Deux projets de recherche ont été menés dans l'atteinte de cet objectif : un sondage auprès des membres d'équipage et l'analyse des bases de données sur les comptes rendus d'accidents. Ces projets de recherche sont documentés dans le présent rapport.

- Sondage auprès des membres d'équipage : Une enquête a été menée auprès de pilotes canadiens, américains et internationaux pour obtenir des informations sur les inspections de contamination avant le décollage, pour déterminer s'ils accepteraient/souhaiteraient l'utilisation d'un ROGIDS à l'extrémité de départ d'une piste, et pour recueillir des informations accessoires sur la fréquence des retours pour dégivrage.
- Analyse de données sur les comptes rendus d'événements : Deux bases de données (SCRQEAC et ASRS) ont été interrogées afin de déterminer si l'utilisation de ROGIDS aurait pu prévenir la survenue d'événements rapportés. L'une des bases de données (SCRQEAC) ne fournissait pas suffisamment de détail pour procéder à cette évaluation, mais 42 rapports pertinents ont pu être tirés de l'ASRS.

Ces deux projets de recherche ont mis en lumière le fait que l'installation d'un ROGIDS à l'extrémité de départ d'une piste pouvait avoir d'importantes répercussions positives sur la sécurité. Par conséquent, il est recommandé que des ressources soient allouées afin de promouvoir le recours à la technologie des ROGIDS en bout de piste, et que ce travail soit mené avec l'aide et le soutien du groupe de travail sur les ROGIDS.

CONTENTS

Page

LIST OF APPENDICES

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LIST OF TABLES

Page

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GLOSSARY

APS	APS Aviation Inc.
AS	Aerospace Standard
ASRS	Aviation Safety Reporting System (United States)
ATIS	Automatic Terminal Information System
CADORS	Civil Aviation Daily Occurrence Reporting System (Canada)
CDA	Canadian
FAA	Federal Aviation Administration
HOT	Holdover Time
MC	Multiple Choice
MEL	Minimum Equipment List
OE	Open Ended
ROGIDS	Remote On-Ground Ice Detection Systems
TC	Transport Canada
TDC	Transportation Development Centre
US	United States
US/INT	United States/International

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1. INTRODUCTION

Under winter precipitation conditions, aircraft are cleaned with a freezing point depressant fluid and protected against further accumulation by an additional application of such a fluid, possibly thickened to extend the protection time. Aircraft ground deicing had, until recently, never been researched and there is still an incomplete understanding of the hazard and potential solutions to reduce the risks posed by the operation of aircraft in winter precipitation conditions. This "winter operations contaminated aircraft – ground" program of research is aimed at overcoming this lack of knowledge.

Since the early 1990s, the Transportation Development Centre (TDC) of Transport Canada (TC) has managed and conducted de/anti-icing related tests at various sites in Canada; it has also coordinated worldwide testing and evaluation of evolving technologies related to de/anti-icing operations with the co-operation of the United States (US) Federal Aviation Administration (FAA), the National Research Council Canada, the Meteorological Service of Canada, several major airlines, and deicing fluid manufacturers. The TDC is continuing its research, development, testing and evaluation program.

Under contract to the TDC, with financial support from the FAA, APS Aviation Inc. (APS) has undertaken research activities to further advance aircraft ground de/anti-icing technology.

1.1 Background

The SAE G-12 Ice Detection Committee Remote On-Ground Ice Detection Systems (ROGIDS) Working Group has been evaluating and supporting the development and use of ROGIDS since 2003. This work has been led, funded, and supported by the FAA and TC. APS has been a key consultant to the group and has conducted much of the group's research and support activities. In addition to representatives from the FAA, TC, and APS, the working group includes representatives from ROGIDS manufacturers, potential ROGIDS users (including airlines and deicing service providers), and aircraft manufacturers.

The ROGIDS working group was formed following the June 2003 International Icing Conference after calls by ROGIDS manufacturers for regulatory agencies like the FAA and TC to develop a definitive path by which ROGIDS could be approved for use.

During the winter of 2004-05, APS conducted research in conjunction with FAA human factors experts that demonstrated that, in certain circumstances, ROGIDS are more reliable than human visual and/or tactile checks in detecting clear ice on aircraft

critical surfaces. This work is documented in two FAA reports: DOT/FAA/TC-06/20, *Comparison of Human Ice Detection Capabilities and Ground Ice Detection System Performance Under Post Deicing Conditions* (1) and DOT/FAA/TC-06/21, *Human Visual and Tactile Ice Detection Capabilities under Aircraft Post Deicing Conditions* (2).

From 2005 to 2007, the working group developed an aerospace standard (AS) defining the minimum operational performance requirements for ROGIDS. The standard was published in September 2007 as SAE AS5681, *Minimum Operational Performance Specification for Remote On-Ground Ice Detection Systems* (3).

From 2007 to 2008, the working group assisted TC and the FAA to develop Advisory Circulars for use of ROGIDS as a primary means of conducting a post-deicing inspection of clear ice on aircraft. The working group provided the recommended document to the regulators in December 2008. The Transport Canada Advisory Circular 602-001, *Operational Use of Remote On-Ground Ice Detection Systems (ROGIDS) for Post De-icing Applications* (4) was published in April 2009; the FAA Advisory Circular 120-107, *Use of Remote On-Ground Ice Detection System* (5) was published in January 2011. Both are available online.

Once these tasks were completed, the working group began assessing other applications for the technology, including end-of-runway, engine icing, and pre-deicing. It was determined that the end-of-runway application would become the next focus for the group.

1.2 Project Objectives

A project plan for the end-of-runway application was drafted at a meeting in June 2009 and revised at meetings in September and December of that year. Initial discussions by the working group determined that it was necessary to research and document the need for ROGIDS in end-of-runway applications before any operational research was conducted or regulatory documents were drafted.

This report documents the work completed to achieve this objective. Specifically, the objective was met through the completion of two research projects: a survey of flight crews and an analysis of incident reporting data. Section 2 of this report details the flight crew survey and Section 3 of this report details the analysis of incident reporting data.

The detailed project objectives are provided in Appendix A in an excerpt from the TDC statement of work for the Winter 2011-12 aircraft anti-icing research program.

2. FLIGHT CREW SURVEY

This section describes the flight crew survey that was carried out to gather information from airline pilots.

2.1 Survey Objectives

The objective of the ROGIDS flight crew survey was to gather information and opinions from airline pilots to assess the need for ROGIDS in an end-of-runway application.

The survey had three objectives, as detailed below. Survey questions were developed to gather information on various elements of each objective.

2.1.1 Objective #1: Gather Information on Pre-Takeoff Contamination Checks

- Determine how and from where pilots conduct pre-takeoff contamination checks.
- Have pilots identify obstacles to identifying contamination accurately during checks (e.g., inadequate training, lighting).
- Determine how confident pilots are in the accuracy of their checks. It should be noted that the purpose of this element was to evaluate pilots' opinions on the accuracy of their checks, not to measure the actual accuracy of their checks – this would require operational tests.

2.1.2 Objective #2: Determine If Pilots Would Accept / Want ROGIDS

- Determine if pilots think ROGIDS would improve safety.
- Determine if pilots would want ROGIDS to replace their contamination checks, provide information that they would use in conjunction with their contamination checks, or neither.
- Determine the form that pilots would want to receive information from ROGIDS (i.e., a go/no go indication or a schematic of contaminated surfaces).

2.1.3 Objective #3: Gather Information on Frequency of Deicing-Related Turnbacks

- Gather information from pilots to determine how commonly aircraft turn back due to icing and de/anti-icing issues.
- Gather information from pilots to determine the specific reasons that these turnbacks occur.

It should be noted that Objective #3 was a secondary objective and completed only to get a general idea of how frequently deicing-related turnbacks occur. As actual data is difficult to obtain, and anecdotal evidence from the working group varied widely, it was felt this would be a useful objective. Actual data may be researched in future if more robust information is required.

2.2 Survey Development

The flight crew survey was developed by APS with significant input from the FAA and TC. In addition, draft versions of the survey were circulated to the ROGIDS working group for feedback and comments.

There are several differences in the terminologies used in the US and Canada for icing contamination checks. The guidelines for how these checks must be carried out also differ between the two countries. The differences in terminology and usage are described in Subsection 2.2.1.

To ensure Canadian and American pilots were not misled by the terminology used in the survey, Canadian and US versions of the survey were created. The Canadian version used the term “Pre-Take-Off Contamination Inspection” and the US version used “Pretakeoff Checks and Pretakeoff Contamination Checks.” The surveys were otherwise identical.

Copies of the survey are included in Appendix B (Canadian version) and Appendix C (US version). International respondents were directed to the US version of the survey, as it is believed that many countries adopt the FAA ground icing guidance materials.

2.2.1 Icing Contamination Check Terminology and Guidance

In Canada, icing contamination checks are referred to as “Pre-Take-Off Contamination Inspections”. The checks are required as follows [as described in Transport Canada report, TP 14052E, *Guidelines for Aircraft Ground Icing Operations* (6)]:

1. If elapsed time is less than the lowest time in the applicable holdover time (HOT) cell, no inspection is required;
2. If elapsed time is within the HOT range provided in the applicable HOT cell, pre-takeoff contamination inspection is required prior to takeoff; and
3. If the maximum HOT is exceeded (i.e., the highest time in the applicable HOT cell), for Type II/III/IV anti-icing fluids only and provided the pertinent minimum HOT equals or exceeds 20 minutes, pre-takeoff contamination inspection is required from outside the aircraft. (No inspections are required or allowed to extend the HOT if the minimum HOT is less than 20 minutes.)

In the US, contamination checks are conducted under two scenarios [as documented in FAA Advisory Circular 120-60B, *Ground Deicing and Anti-icing Program* (7)]. The terminology used in each scenario is different:

1. The "Pretakeoff Check" is conducted within the HOT; and
2. The "Pretakeoff Contamination Check" is conducted if the HOT has been exceeded. Flight crews must complete the pretakeoff contamination check within 5 minutes of takeoff. This check must be accomplished from outside the aircraft unless the certificate holder's program specifies otherwise.

2.3 Survey Administration

The survey was administered from September 2010 to January 2011 using web-based survey software. As described in the previous subsection, two versions of the survey were created due to differences in terminology: a Canadian version and a US version.

Respondents were asked between 10 and 30 questions. The number of questions each respondent was asked depended on their specific responses to some questions. Responses to these questions determined if following questions were applicable.

The survey was conducted with no personal identifying information; individual respondents' identities could not be determined. This was done to ensure respondents were aware their participation and responses were completely anonymous. It was thought this would increase overall response rates and elicit more candid answers.

2.4 Survey Distribution

The survey was distributed to potential respondents through key airline and industry representatives. These representatives were contacted in advance, and when they agreed to assist in the distribution of the survey, they were sent an email with a link to the survey website.

The organizations/representatives that assisted in distribution of the survey included:

- Air Canada Pilots Association (Louis Doré);
- Air Transport Association of Canada (Bill Boucher);
- American Airlines (Don Borntrager);
- Canadian Business Aviation Association (Art Laflamme/Peter Saunders);
- Continental Airlines (Scott Klein);
- Irish Pilots Association (Paul Hannity);
- UPS (John O'Neil);
- US Airways (Ron Thomas); and
- WestJet (Darcy Granley).

The support of these organizations was critical to the success of this project. On behalf of all those involved in this project, the author thanks these organizations and individuals for their help and support.

2.5 SAE G-12 Ice Detection ROGIDS Working Group Participation

The flight crew survey was developed during meetings of the ROGIDS working group, primarily at the December 2009 meeting held at the FAA Center for Management and Executive Leadership in Palm Coast, Florida. The working group reviewed the survey content prior to its dissemination.

Working group members who participated in the development of the survey included Stephanie Bendickson, APS; John D'Avirro, APS; Louis Doré, ACPA; Chuck Enders, FAA; Dennis Gregoris, PV Labs; Doug Ingold, Transport Canada; Graham Morgan, Servisair; Ed Pugacz, FAA; Mario Rosa, Aeromag 2000; and Clint Tanner, Bombardier.

2.6 Summary of Survey Respondents

Responses were collected from 756 individuals, including 496 who completed the Canadian version of the survey and 260 who completed the US survey.

An attempt was made to include pilots with the following attributes:

- Flying a variety of aircraft;
- Based in different geographic locations;
- Working for different companies; and
- Having varying years of experience.

Further information about the respondents was provided by the classification questions asked at the end of the survey. This information is provided in Subsection 2.7.5.

2.7 Survey Responses by Question

The survey responses are detailed in this subsection by question. The survey was divided into several parts, and the responses are presented here by those parts:

- Part 1: Pre-Take-off Contamination Inspections (Subsection 2.7.1);
- Part 2: Repeat De/Anti-Icing Operations (Subsection 2.7.2);
- Part 3: Training (Subsection 2.7.3);
- Part 4: Potential Use of ROGIDS (Subsection 2.7.4);
- Part 5: General Questions (Subsection 2.7.5); and
- Part 6: Comments (Subsection 2.7.6).

For each question, the following is provided: question number, question text, question type [Multiple Choice (MC) or Open Ended (OE)], and responses. The responses to multiple choice questions are shown for all respondents (raw number and percentage), Canadian (CDA) respondents, and US/International (US/INT) respondents. Open-ended responses have been categorized.

It should be noted that the Canadian terminology is used in this section (see Subsection 2.2).

2.7.1 Part 1: Pre-Takeoff Contamination Inspections

The purpose of the questions in Part 1 was to gain information about pre-take-off inspections.

Question 1 (MC): Have you ever conducted a pre-take-off contamination inspection on your aircraft?

Response	All (#)	All (%)	CDA	US/INT
Yes	726	96%	98%	92%
No	30	4%	2%	8%

Note: Respondents answering "Yes" were directed to Question 2; respondents answering "No" were directed to Question 8.

Question 2 (MC): From where does your company (you or others) conduct pre-take-off inspections? Select any/all that apply.

Response	All (#)	All (%)	CDA	US/INT
Cockpit / flight deck	358	49%	38%	73%
Cabin	611	84%	93%	66%
Outside the aircraft	294	41%	28%	67%
Other	28	4%	3%	5%

Question 3 (OE): What area(s) of the aircraft do you inspect when performing a pre-take-off contamination inspection? Please be as specific as possible.

Top 10 Responses:

1. Wings (86%)
2. Wings, upper surface (28%)
3. Leading Edge (25%)
4. Tail (10%)
5. Engines (9%)
6. Fuselage (9%)
7. Spoilers (7%)
8. Trailing Edge (7%)
9. Flaps/slat (6%)
10. Windshield (6%)

Other Responses (in decreasing order of frequency, all less than 6%):

- Representative surfaces
- Wing from cabin
- Horizontal stabilizer
- Control surfaces
- Wipers
- Nose
- Wing (root)
- Wing (bottom)
- Entire aircraft
- Pitot/static
- Critical surfaces
- Ailerons
- Vertical stabilizer
- Winglet/wing tip
- Elevators
- Landing gear
- Left, right, first wing
- Wing from cockpit
- Wheel wells

Question 4 (MC): Do any of the following impede your ability to conduct these inspections? Select any/all that apply.

Response	All (#)	All (%)	CDA	US/INT
Inadequate lighting (night-time visibility, insufficient artificial lighting)	573	79%	79%	79%
Visibility impeded by winter precipitation	379	52%	54%	49%
Cabin configuration (difficulty seeing wing due to location of passengers and cabin windows)	341	47%	49%	42%
Visibility impeded by de/anti-icing fluid	338	47%	51%	38%
Large distances to wing tips	205	28%	24%	38%
Crazed windows	199	27%	26%	29%
Time constraints	120	17%	13%	23%
Uncertainty in what to look for	74	10%	9%	13%
High wing configuration	25	3%	2%	7%
No windows in cabin	1	0%	0%	0%
None of the above	76	10%	12%	7%

Question 5 (OE): Are there any other factors that impede your ability to conduct these inspections?

Responses (categorized):

- No access to ladder/steps (17 responses, 2%)
- Security (13 responses, 2%)
- Passenger interactions (10 responses, 1%)
- Interior cabin lighting (10 responses, 1%)
- Workload during taxi (7 responses, 1%)
- Can't see tail (7 responses, 1%)
- Flashlight insufficient (6 responses, 1%)
- Inadequate training (5 responses, 0.5%)

Select interesting responses (verbatim):

- "It's not pleasant walking into a full cabin and leaning over passengers looking thru obscured windows at night trying to figure out if the deicing fluid has 'failed'."
- "A PCI is RIDICULOUS from the cabin. I did one 2 days ago with a full cabin in Calgary; I was supposed to bend over two big overweight guys trying to look through a 60 square-inch dirty plastic window to determine if 90 feet of wing is clean!... stupid... dangerous... useless."
- "The physical size of large aircraft makes it impractical or impossible to see all critical surfaces from outside, and from inside the cabin – trying to see a large, poorly lit surface through a small deicing fluid/precipitation smeared window is often useless."
- "A tactile inspection of the leading edges is the only way to test for ice. I have looked from 2 feet away and could not see ice, yet scraping my company ID along the leading edge (B757 from fueling stand) revealed 1/4 inch of clear ice."

Question 6 (MC): Are you confident that the present method of performing pre-take-off contamination inspections can accurately determine whether contamination is present on the aircraft and that the deicing / anti-icing fluid is still effective?

Response	All (#)	All (%)	CDA	US/INT
Yes, very confident	241	33%	37%	25%
Somewhat confident	366	50%	47%	58%
No, not confident	119	16%	16%	16%

Question 7 (MC): To what extent does conducting a pre-take-off contamination inspection affect the flight crew?

Response	All (#)	All (%)	CDA	US/INT
Minimal disruption to workload	162	22%	25%	16%
Slight disruption to workload	423	58%	57%	60%
Excessive disruption to workload	140	19%	17%	23%

Question 8 (MC): Why don't you conduct these inspections? Question 9 (OE): On the previous page you indicated "other" as the reason you don't conduct pre-take-off contamination inspections. Please describe the reason.

Response	All (#)	All (%)
Unfamiliar with this type of inspection	7	23%
Inspections not possible in my aircraft type	3	10%
Do not fly in winter weather conditions	8	27%
Delegate to someone else	7	23%
Check not authorized	2	7%
Choose to re-treat instead	1	3%
Not comfortable with liability	1	3%
Other (unspecified)	1	3%

Note: The responses to Questions 8 and 9 have been merged. Only the 30 respondents who indicated they do not conduct these inspections (in Question 1) were asked these questions. The percentage column indicates the percentage of the 30 who provided each response.

2.7.2 Part 2: Repeat De/Anti-Icing Operations

The purpose of the questions in Part 2 was to determine how frequent/common it is to re-treat an already de/anti-iced aircraft and why the re-treatments were necessary.

Question 10 (MC): After being deiced and/or anti-iced and having departed the gate/pad/deicing centre, have you ever had to request a second de/anti-icing be conducted?

Response	All (#)	All (%)	CDA	US/INT
Yes	415	55%	54%	57%
No	338	45%	46%	43%

Note: Respondents answering "No" were directed to Question 19.

Questions 11 to 17 (MC): Have you ever had to request a second de/anti-icing for the reasons below?

- Q11: HOT expired (340 responses, 45%)
- Q12: Flight crew OBSERVED contamination (225 responses, 30%)
- Q13: Flight crew SUSPECTED contamination (170 responses, 22%)
- Q14: Cabin crew/passenger reported contamination (90 responses, 12%)
- Q15: Weather changed, takeoff deemed unsafe (203 responses, 27%)
- Q16: Unable to takeoff w/i 5 minutes of inspection (77 responses, 10%)
- Q17: Other (22 responses, 3%)

Questions 11 to 17 (MC): How many times have you had to request a second de/anti-icing for each of the reasons given below?*

Question	Rpd.	1	2-3	4-5	6-10	>10	All
Q11 Holdover time expired	**ALL**	**20%**	**18%**	**4%**	**2%**	**0%**	**45%**
	CAN	20%	17%	2%	2%	0%	41%
	US/I	20%	21%	7%	4%	0%	52%
Q12 Flight crew OBSERVED contamination	**ALL**	**18%**	**10%**	**1%**	**1%**	**1%**	**30%**
	CAN	18%	10%	1%	1%	0%	29%
	US/I	18%	9%	1%	1%	2%	31%
Q13 Flight crew SUSPECTED contamination	**ALL**	**15%**	**6%**	**1%**	**1%**	**0%**	**22%**
	CAN	15%	4%	0%	1%	0%	21%
	US/I	15%	8%	2%	1%	0%	26%
Q14 Cabin crew / passenger reported contamination	**ALL**	**9%**	**3%**	**0%**	**0%**	**0%**	**12%**
	CAN	11%	4%	0%	0%	0%	15%
	US/I	6%	1%	0%	0%	0%	7%
Q15 Weather changed and take-off was deemed unsafe	**ALL**	**15%**	**10%**	**1%**	**1%**	**0%**	**27%**
	CAN	14%	9%	1%	0%	0%	25%
	US/I	17%	12%	1%	1%	0%	31%
Q16 Exceeded req't to become airborne within 5 mins of PCI	**ALL**	**6%**	**3%**	**0%**	**1%**	**0%**	**10%**
	CAN	6%	2%	0%	1%	0%	9%
	US/I	6%	4%	0%	2%	0%	12%
Q17 Other (specify below)	**ALL**	**2%**	**1%**	**0%**	**0%**	**0%**	**3%**
	CAN	2%	1%	0%	0%	0%	3%
	US/I	1%	0%	1%	0%	0%	3%

* *The percentages in the table above are calculated as the number of responses divided by the total number of respondents in the group (i.e., ALL = 756, CAN = 496, US/I = 260).*

Question 18 (OE): Other, specify (continuation of Question 17)

Responses (categorized):

- Improper initial treatment (7 responses, 2%)
- Flight delays (5 responses, 1%)
- Contamination found when flaps configured for t/o (3 responses, <1%)
- Deicing crew found contamination (2 responses, <1%)
- Snowflake operation discovered contamination (2 responses, <1%)

2.7.3 Part 3: Training

The objective of the questions in Part 3 was to gather information about pilot training on de/anti-icing.

Question 19 (MC): How do you identify de/anti-icing fluid failure? This can be based on any training you have received and/or on your personal experience. Please select any/all that apply.

Response	All (#)	All (%)	CDA	US/INT
Build-up of ice crystals in or on the fluid	319	45%	42%	51%
Loss of colour in fluid	267	37%	39%	35%
Build-up of snow on fluid	526	74%	77%	67%
Ice or slush in fluid	420	59%	60%	56%
Progressive surface freezing	208	29%	29%	29%
Dulling of surface reflectivity (loss of gloss)	444	62%	73%	39%
Other (specify below)	46	6%	4%	11%

Other OE responses (categorized):

- Based on HOTs (38 responses, 5%)
- Don't know how/impossible (10 responses, 1%)
- Can't see fluid anymore (3 responses, <1%)
- Uneven fluid (3 responses, <1%)
- Precipitation intensity (2 responses, <1%)

Question 20 (MC): Does your company provide training to help you identify when de/anti-icing fluids have failed?

Response	All (#)	All (%)	CDA	US/INT
Yes	508	67%	79%	46%
No	245	33%	21%	54%

Note: Respondents answering "No" were directed to Question 23.

Question 21 (OE): Briefly describe the de/anti-icing fluid failure training you receive (i.e. pictures, descriptions, demonstrations, etc.).

- Description (247 responses)
- Pictures (145 responses)
- ART/Briefing (107 responses)
- Video (91 responses)
- Manuals/bulletins (65 responses)
- CBT (42 responses)
- PowerPoint (12 responses)
- HOT Charts (10 responses)
- Self-study (9 responses)
- Simulators (3 responses)

Note: Some of the 508 respondents that answered "Yes" to Question 20 described multiple fluid failure training types; therefore, the total responses to Question 21 add up to more than 508.

Question 22 (MC): Do you feel this training adequately prepares you to conduct an accurate de/anti-icing fluid failure inspection in operations?

Response	All (#)	All (%)	CDA	US/INT
Yes	379	75%	75%	75%
No	128	25%	25%	25%

Note: This question was only asked of the 67% of respondents who indicated they receive training (see Question 20).

2.7.4 Part 4: Potential Use of ROGIDS

The purpose of the questions in Part 4 was to gather insight into pilots' opinions of ROGIDS. The questions in this section were preceded with this description of ROGIDS:

> *"Remote on-ground ice detection systems (ROGIDS) are currently being developed to check for ice during post-deicing checks (checks conducted immediately following deicing). Further development may allow the use of ROGIDS to replace the pre-take-off contamination inspection (ROGIDS equipment would be installed near the end of the runway)."*

Question 23 (MC): Assuming ROGIDS are proven to have the ability to accurately determine de/anti-icing fluid failure, would you support their use as an alternative to flight crews performing pre-take-off contamination inspections?

Response	All (#)	All (%)	CDA	US/INT
Yes, I would allow ROGIDS to replace my pre-take-off contamination inspection	264	35%	36%	33%
Yes, I would use ROGIDS in conjunction with my pre-take-off contamination inspection	419	56%	53%	61%
No, I would not support the use of ROGIDS for this application (please explain why below)	65	9%	10%	5%

Those who responded "No" were asked why (OE). Responses:

- Technology has flaws/don't trust it (19 responses, 3%)
- I can do a better job (9 responses, 1%)
- It is the flight crew's responsibility (9 responses, 1%)
- Benefit does not outweigh cost (6 responses, <1%)
- Concerned it will be too restrictive/cause delays (6 responses, <1%)
- Not needed; current system works (5 responses, <1%)
- Will weaken pilot authority (5 responses, <1%)

Question 24: The information available from ROGIDS could be provided to flight crews in a number of ways. What do you think flight crews would prefer?

Response	All (#)	All (%)	CDA	US/INT
A go/no go system	394	54%	52%	57%
A picture showing contamination on the examined part of the aircraft	257	35%	36%	34%
Other (specify below)	83	11%	12%	9%

Other OE responses (categorized):

- Provide info, not decision (17 responses, 2%)
- Verbal communication (15 responses, 2%)
- Combination of picture and go/no go (13 responses, 2%)
- Go/no go with pilot override option (6 responses, 1%)
- Visual presentation (4 responses, <1%)

Question 25 (OE): The development and regulatory approval of ROGIDS may take several years. Do you have any suggestions for alternate methods/procedures/ equipment that could improve the inspection process in the interim?

Responses (categorized):

- Have qualified person do inspections near takeoff area (51 responses, 7%)
- Deice at end of runway (32 responses, 4%)
- Better training of flight and/or ground crews (23 responses, 4%)
- Better lighting at holding bay/end-of-runway (22 responses, 3%)
- Airport strategies to minimize time between deicing and departure (12 responses, 2%)
- Liquid water equivalent system (12 responses, 2%)
- Regular cameras (11 responses, 1%)

2.7.5 Part 5: General Questions

The questions in Part 5 were asked to provide a better understanding/profile of the survey respondents.

Question 26 (OE): Aircraft Types Flown

The following are the top 40 aircraft types listed (and the number of respondents mentioning each type):

1. Airbus 320 (369)
2. Boeing 737 (340)
3. Boeing 767 (211)
4. Embraer 170/175/190 (139)
5. Boeing 727 (137)
6. Boeing 757 (107)
7. Airbus 330 (106)
8. DeHavilland DH8 (93)
9. McDonnell-Douglas DC9 (93)
10. Cessna Misc (92)
11. McDonnell-Douglas MD80 (70)
12. Beech 1900 (66)
13. Boeing 777 (62)
14. Military Misc (61)
15. Airbus 319 (56)
16. Canadair RJ (44)
17. Airbus 340 (43)
18. Beech 200 (40)
19. Boeing 747 (37)
20. British Aerospace 146 (36)
21. Piper Misc (36)
22. Fokker 28 (32)
23. Beech 100 (31)
24. DeHavilland DH6 (31)
25. Lockheed 1011 (29)
26. McDonnell-Douglas DC10 (29)
27. Fairchild 2/3 (27)
28. McDonnell-Douglas DC8 (24)
29. Fokker 100 (23)
30. Canadair 65 (22)
31. Fokker 50 (21)
32. British Aerospace 31 (20)
33. Learjet Misc (20)

34. Fairchild 4/5 (18)
35. ATR42 (17)
36. McDonnell-Douglas DC3 (15)
37. Short Misc (15)
38. Airbus 321 (13)
39. DeHavilland DH7 (13)
40. Hawker-Siddeley 748 (13)

Note: Another 37 aircraft types were mentioned.

Question 27 (MC): Years of Commercial Flying Experience:

Response	All (#)	All (%)	CDA	US/INT
< 5 years	9	1%	1%	2%
5-10 years	55	7%	8%	5%
11-20 years	265	35%	39%	28%
21-30 years	269	36%	31%	46%
> 30 years	154	20%	21%	19%

Question 28 (MC): Approximate number of times you have been deiced or anti-iced in your career:

Response	All (#)	All (%)	CDA	US/INT
1-10	6	1%	0%	2%
11-50	125	17%	8%	35%
51-100	188	25%	24%	28%
101-250	237	32%	36%	24%
> 250	191	26%	33%	12%

2.7.6 Part 6: Comments

Part 6 provided a place for survey respondents to provide any additional comments they had on the survey and its subject matter.

Question 29 (OE): Do you have any additional comments on the questions in the survey, pre-take-off contamination inspections and/or ROGIDS? Please use the space below to provide us with your feedback.

Responses categorized and shown in decreasing order of frequency:

- Thanks / support initiative (31 responses)
- PCI are ineffective / alternative needed (21 responses)
- Solution is to deice at end-of-runway (9 responses)
- Accept a system that provides additional info, not one that replaces captain's authority (8 responses)
- Improve airports/ATC (6 responses)
- Night/poor weather worst times for PCI (6 responses)
- Improve training (5 responses)
- Rely on ground crew (5 responses)
- Replace PCI with external check by qualified personnel at end-of-runway (5 responses)
- Current system works, don't change (4 responses)
- KISS – keep it simple (4 responses)
- People are over deicing (4 responses)
- Support if not punitive/time-consuming (4 responses)
- Pilots should have final say (3 responses)
- Improve a/c lighting (2 responses)
- Would like to see return of Dan Ice (2 responses)
- Full test program required to gain pilot support (2 responses)
- Depend on HOTs (1 response)
- Difficult for flight crews b/c info is spread out and all airports different (1 response)
- Don't support – due to costs (1 response)
- Don't support – lack of trust in technology (1 response)
- Fluid on windscreen biggest problem (1 response)
- PCI are inefficient due to PAX questions (1 response)
- Request flight crew involvement in ROGIDS dev. (1 response)
- ROGIDS should be operated independently (1 response)
- Tail requires attention (1 response)
- Visual of wing from flight deck would help (1 response)
- Would like to see more work for smaller a/c and airports (1 response)

2.8 Key Information Derived from Survey

1. Pilot opinions on this issue vary substantially, from "no more regulations" to "we are desperate for this."

2. In general, pilots support ROGIDS if they do not slow down or prevent operations, and if they are used in conjunction with the pilot's own assessment.

3. It appears some respondents may have confused a pre-takeoff contamination check (completed just prior to takeoff) with the earlier check conducted at the gate. This confusion was likely due to some of the areas that were included in the inspections and the location where the inspections were conducted (i.e., at the gate).

4. A significant number of pilots surveyed (78%) say inadequate lighting impedes their ability to do pre-takeoff contamination checks.

5. Almost half of pilots surveyed (47%) find pre-takeoff contamination checks difficult due to the configuration of aircraft cabins.

6. Wings are checked during pre-takeoff contamination checks; most other areas of aircraft are not.

7. One-third of pilots surveyed (33%) receive no training for pre-takeoff contamination checks, yet only 16% are "not confident" in their ability to conduct these checks.

8. A small number of pilots surveyed (5%) rely on HOTs to determine if fluid failure has occurred.

9. More than half of pilots surveyed (55%) have had to request a second deicing. The most common reason for re-treatments was that the HOT had expired. The second most common was the flight crew identifying contamination on the aircraft.

10. Two alternatives to ROGIDS were mentioned frequently (to the direct question on alternate solutions but also to other questions):

    - Reduce time between deicing and departure by locating deicing pads near end-of-runway; and
    - Have a trained person near the end-of-runway conducting the checks from outside the aircraft.

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3. EVALUATION OF INCIDENT DATA

This section describes the analysis of incident reporting data. Incident reports related to aircraft ground icing were collected and examined to determine if ROGIDS could have prevented the incidents from occurring.

3.1 Objective

The objective of analysing the incident reporting data was to determine if ROGIDS could have prevented the occurrence of any of the reported incidents.

3.2 Databases

Data was collected from two reporting system databases.

1. Aviation Safety Reporting System (ASRS): The US ASRS represents an effort by government, industry, and individuals to maintain and improve aviation safety. The ASRS collects voluntarily submitted aviation safety incident/situation reports from pilots, controllers, and others. The system is administered by NASA.

2. Civil Aviation Daily Occurrence Reporting System (CADORS): TC uses this system to collect aviation occurrence information. The purpose of the system is to provide initial information on occurrences involving any Canadian-registered aircraft, as well as events that occur at Canadian airports, in Canadian sovereign airspace, or international airspace for which Canada has accepted responsibility, which includes events involving foreign-registered aircraft.

The CADORS incident reports contain limited descriptions of the incidents and circumstances surrounding the incidents. This made it difficult to complete the analysis necessary for this project. As a result, the detailed analysis was limited to the data from the ASRS database.

3.3 Data Analysis Procedure

Data was collected, selected, and analysed using the multi-step procedure described on the following page.

1. Key word searches were conducted in the ASRS and CADORS databases to collect incident reports related to aircraft ground icing.

2. Incident reports that were unrelated to the potential use of ROGIDS were removed.

3. The remaining incident reports were categorized by the nature of the incident. The following incident categories were identified:

    - Failure to deice;
    - Failure to identify contamination;
    - Difficulty identifying contamination;
    - Ice in engines;
    - Inadequate de/anti-icing treatments;
    - Fluid failure before predicted HOT; and
    - Cabin crew suspects contamination.

4. The ROGIDS application or applications that may have prevented the incident from occurring were identified for each incident report. The four ROGIDS applications are as follows:

    - Engine Icing: Using ROGIDS to examine engines for contamination;
    - Pre-Deicing: Using ROGIDS to examine aircraft surfaces for contamination prior to deicing (to determine if deicing is required);
    - Post-Deicing: Using ROGIDS to examine aircraft surfaces for contamination following de/anti-icing treatment (to determine if deicing treatment successfully removed all contamination); and
    - End-of-Runway: Using ROGIDS to examine aircraft surfaces for contamination just prior to takeoff near the departure end of the runway (to determine if any contamination is present, regardless of whether the aircraft was or was not deiced).

3.4 Data

The ASRS database was thoroughly reviewed and filtered to include only incidents related to potential ROGIDS applications. The database spanned a ten-year period from February 1999 to January 2009. The filtering process resulted in 42 incident reports being selected for examination (see steps 1 and 2 above). The incident reports are summarized in Table 3.1, which includes the ASRS number, incident type, potential ROGIDS application(s), and synopsis. A detailed narrative for each incident report is provided in Appendix D.

Table 3.1: Incident Reports Summary

No.	Incident Type	ROGIDS Application(s)	Synopsis
18 ACN: 765422	Failure to Deice	End-of-Runway	An Embraer135 departed without deicing while light freezing rain was being reported on the automatic terminal information system (ATIS).
62 ACN: 534476	Failure to Deice	Pre-Deicing, End-of-Runway	A B777-200 first officer was intimidated to depart by company chief pilot and captain after she informed them there was ice adhering to the aircraft and wings.
59 ACN: 537082	Failure to Deice	End-of-Runway	Ice accumulated on the inbound leg was removed, but after the subsequent departure, an aircraft observer claimed deicing holdover time processes were not complied with.
61 ACN: 535551	Failure to Deice	Pre-Deicing, End-of-Runway	Local controller during a snowstorm received a request from an Embraer 135 and later from an Embraer 145 for taxi clearance to the runway for takeoff. Both aircraft were heavily covered with snow and skipped deicing.
22 ACN: 764827	Failure to Identify Contamination	End-of-Runway, Pre-Deicing	A Boeing 737 pilot perceived his aircraft wings were free of ice before takeoff and therefore did not deice. Deadheading pilots reported significant wing ice at takeoff.
64 ACN: 496272	Failure to Identify Contamination	Pre-Deicing, End-of-Runway	An MD80 crew allegedly took off with snow adhering to the leading edge of the wings and upper fuselage.
68 ACN: 493770	Failure to Identify Contamination	Pre-Deicing, End-of-Runway	A Boeing 757 crew, operating in snow, had a passenger point out that the aircraft needed deicing.
59 ACN: 541519	Failure to Identify Contamination	Pre-Deicing, End-of-Runway	A Boeing 757-200 deadheading company captain advised the captain that the aircraft wings were contaminated with frost. This occurred on taxi to the runway.
30 ACN: 729323	Failure to Identify Contamination	End-of-Runway	An Airbus A320 pilot reported takeoff with ice pellets and snow falling but without a holdover time checklist to cover the existing conditions.

Table 3.1: Incident Reports Summary (cont'd)

No.	Incident Type	ROGIDS Application(s)	Synopsis
66 ACN: 494980	Difficulty Identifying Contamination	Pre-Deicing, Engine Icing	A Boeing 727-200 first officer inadvertently deployed the aft galley door evacuation slide when opening it to check for ice accumulation in engine at the ramp.
10 ACN: 780689	Difficulty Identifying Contamination	Pre-Deicing	Captain reported the ground crew's attempt to circumvent his request for deicing prior to departure.
50 ACN: 575009	Difficulty Identifying Contamination	Pre-Deicing	During preflight checks, a pilot had an inadvertent activation of an Airbus A319 over wing escape slides when opening the exit to inspect for ice accumulation on the wing.
7 ACN: 816184	Difficulty Identifying Contamination	Pre-Deicing	An Airbus A320 right wing inspection/scan light was inoperative during night and snow operations. The minimum equipment list (MEL) prohibits release under these conditions, yet until the flight crew refused the aircraft, maintenance was not inclined to repair the light.
4 ACN: 820711	Ice in Engines	Engine Icing	A Boeing 737 pilot noted large amounts of ice and snow in both engines' inlets during preflight. The ice had frozen the fans, and ground air was used to thaw the ice where deicing fluid may damage engine components.
27 ACN: 735255	Ice in Engines	Engine Icing	An MD88 captain expressed concern regarding deicing procedures and air traffic control braking action reporting at Syracuse airport.
28 ACN: 734481	Ice in Engines	Engine Icing	An MD80 captain reported a nose gear strut servicing problem. He also reported that ice, shed from the aircraft nose during climb out, was possibly ingested into the engines, causing damage.

Table 3.1: Incident Reports Summary (cont'd)

No.	Incident Type	ROGIDS Application(s)	Synopsis
29 ACN: 734157	Ice in Engines	Engine Icing	A BA3200 flight crew started engines with snow and ice contamination in engines. Several legs later, a bent compressor blade was discovered by maintenance personnel.
40 ACN: 644722	Ice in Engines	Engine Icing	An MD80 aborted takeoff at 110 knots due to compressor stall. After returning to the gate, the engine fan blades were found to be damaged.
42 ACN: 636478	Ice in Engines	Engine Icing	A Boeing 737-700's engines accumulated fan blade ice during taxi and extended hold for visibility improvement in dense fog and freezing temperatures.
44 ACN: 642026	Ice in Engines	Engine Icing	A Boeing 727-200 engine failed during takeoff in icing conditions following deicing. The crew declared an emergency and return landing.
48 ACN: 598222	Ice in Engines	Engine Icing	A Boeing 737-300 needed to return to the deice pad to be deiced a second time after engine vibration indicators revealed the presence of ice on the fan blades.
56 ACN: 564536	Ice in Engines	Engine Icing	A Boeing 737-300 crew suspected engine fan blade icing that was detected on the vibration monitor.
55 ACN: 564691	Inadequate Deicing/Anti-icing Treatment	Engine Icing	A Boeing 737-300 crew had engine fan blades that had ice accumulation and were damaged.
60 ACN: 536824	Inadequate Deicing/Anti-icing Treatment	End-of-Runway	A C150 went off the end of a 2600-foot runway on a frosty day after frost was purportedly removed from wings during preflight. The runway condition was patchy ice.

Table 3.1: Incident Reports Summary (cont'd)

No.	Incident Type	ROGIDS Application(s)	Synopsis
3 ACN: 821285	Inadequate Deicing/Anti-icing Treatment	Post-Deicing, End-of-Runway	An air carrier pilot commented that, after having been deiced, the next airport ground crew found ice on the horizontal stabilizer and other aircraft parts because they were not properly deiced prior to departure.
11 ACN: 780211	Inadequate Deicing/Anti-icing Treatment	End-of-Runway, Post-Deicing	An Airbus taxiing to the runway was called back to the gate because it was not completely deiced.
14 ACN: 772707	Inadequate Deicing/Anti-icing Treatment	Post-Deicing	A flight crew reported unsatisfactory deicing performance by ground personnel as well as failure to complete required security inspection.
19 ACN: 764953	Inadequate Deicing/Anti-icing Treatment	Post-Deicing	A Saab 340 was improperly deiced. The wings were only partially sprayed, and the propellers only received a fine mist of fluid.
20 ACN: 764940	Inadequate Deicing/Anti-icing Treatment	Post-Deicing	A CRJ200 flight crew discovered ice on the aircraft after having been deiced. The aircraft returned to gate for additional deicing.
25 ACN: 762902	Inadequate Deicing/Anti-icing Treatment	Post-Deicing	A Boeing 757-200 had to be deiced three times before an acceptable result was achieved.
33 ACN: 725169	Inadequate Deicing/Anti-icing Treatment	End-of-Runway, Post-Deicing	An SF350B flight crew reported deicing before departure and, upon arrival at destination, they were notified that they had departed without their tail deiced.
34 ACN: 724933	Inadequate Deicing/Anti-icing Treatment	Post-Deicing	An MD80 captain reported problems with the deicing crew, requiring three attempts to get a satisfactory deicing.
36 ACN: 723765	Inadequate Deicing/Anti-icing Treatment	Post-Deicing, End-of-Runway	An Airbus A300 was not completely deiced and arrived at its destination where ice fell from inside the cargo door. Sluggish flight characteristics were noted.

Table 3.1: Incident Reports Summary (cont'd)

No.	Incident Type	ROGIDS Application(s)	Synopsis
41 ACN: 640668	Inadequate Deicing/Anti-icing Treatment	Post-Deicing	A Boeing 757-200 was not properly deiced and, when the holdover time was exceeded, flight crew insisted on further treatment.
53 ACN: 572973	Inadequate Deicing/Anti-icing Treatment	Post-Deicing	A Boeing 777-200 was not properly deiced.
57 ACN: 542253	Inadequate Deicing/Anti-icing Treatment	Post-Deicing, Engine Icing	A Boeing 737-300 captain complained that the ground crew deicing personnel required three attempts to completely / adequately deice the aircraft prior to flight due to complacency.
63 ACN: 503592	Inadequate Deicing/Anti-icing Treatment	Post-Deicing	Two flights had difficulty obtaining proper deicing treatment during inclement weather.
67 ACN: 494779	Inadequate Deicing/Anti-icing Treatment	Post-Deicing	A Boeing 727-200 returned to the gate for a control check after deicing where it was discovered that the deicing was incomplete / incorrectly accomplished.
43 ACN: 685871	Inadequate Deicing/Anti-icing Treatment	End-of-Runway	A Piaggio Avanti flight crew encountered freezing rain during after an en-route stop for fuel. The flight crew had the ground crew use warm water to remove ice. The ground crew was unfamiliar / uncomfortable with this method.
58 ACN: 541910	Inadequate Deicing/Anti-icing Treatment	Post-Deicing, End-of-Runway	A Dornier 328 had a momentary loss of elevator control on takeoff. The suspected cause was stabilizer snow and ice sliding back into the elevator gap.
1 ACN: 827469	Fluid Failure Prior to Predicted HOT	End-of-Runway	Following lengthy ground delays in blowing snow, an Airbus A319 returned to the gate to be deiced a second time. Visual inspection of the wing leading edge revealed ice the length of both wings despite a time interval of less than the calculated holdover time.

Table 3.1: Incident Reports Summary (cont'd)

No.	Incident Type	ROGIDS Application(s)	Synopsis
6 ACN: 819418	Cabin Crew Suspected Contamination	End-of-Runway	A Boeing 737 flight crew reported a flight attendant's concern that they departed with snow on their wings, although the aircraft was deiced and departed within the calculated holdover time.

3.5 Summary of Data

As described in step 3 above, the incident reports were classified according to the nature of incident. Table 3.2 shows the number of incident reports by the nature of incidents. The "inadequate de/anti-icing treatment" category was seen most frequently, followed by the "ice in engines" category.

As described in step 4 above, the ROGIDS application(s) that could have been used to prevent each incident were identified for each of the incident reports. The number of incident reports related to each ROGIDS application is shown in Table 3.3. Because multiple ROGIDS applications are relevant in several of the incidents, the total number of incident reports in Table 3.3 is higher than the total number of incident reports.

The end-of-runway application was identified as potentially preventing the incident in half of the 42 incident reports. The post-deicing and engine icing applications were identified in approximately 30% of the reports. Pre-deicing was mentioned in only 6 of the 42 reports.

Table 3.2: Incident Reports by Nature of Incident

Nature of Incident	Number of ASRS Incident Reports
Inadequate de/anti-icing treatment	18
Ice in engines	9
Failure to identify contamination	5
Failure to deice	4
Difficulty identifying contamination	4
Fluid failure before predicted HOT	1
Cabin crew suspects contamination	1
TOTAL	**42**

Table 3.3: Incident Reports by ROGIDS Application

ROGIDS Application	Number of ASRS Incident Reports
End-of-Runway	18
Post-Deicing	15
Engine Icing	12
Pre-Deicing	10

3.6 Key Information Derived from Incident Report Data

The incident report data illustrates that ROGIDS could significantly decrease the number of aircraft ground icing safety incidents, most notably by having ROGIDS at the end of the runway to perform a final contamination check prior to departure. ROGIDS also have great potential for reducing damage to aircraft engines due to undetected ice.

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4. CONCLUSIONS AND RECOMMENDATIONS

The work described in this report was performed to research and document the need for ROGIDS at the end of the runway. This work was necessary to determine if operational research should be conducted and regulatory documents drafted to support the advancement of this technology for this currently unapproved use.

The two research projects completed to achieve this objective were both successful in determining a strong need for ROGIDS at the departure end of the runway.

4.1 Flight Crew Survey

The flight crew survey showed general support by pilots for ROGIDS use at the departure end of the runway. The survey revealed that many pilots do not receive adequate training to identify fluid failure. Furthermore, several obstacles prevent pilots from being able to conduct the needed contamination checks adequately (e.g., lighting, cabin configuration, visibility through cabin windows).

4.2 Incident Data

The incident report data illustrates that ROGIDS could have a significant impact on the number of aircraft ground icing safety incidents, with the end-of-runway application having the most impact.

4.3 Recommendations

It is recommended that resources be allocated to advance the use of ROGIDS technology for the end-of-runway application. If this recommendation is supported by research sponsors, the ROGIDS working group should guide and support this work as it did for the post-deicing ROGIDS application.

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REFERENCES

1. Bender, K., D'Avirro, J., Eyre, F., Marcil, I., Pugacz, E., Sierra Jr., E. A., Terrace, S. M., *Comparison of Human Ice Detection Capabilities and Ground Ice Detection System Performance Under Post Deicing Conditions*, FAA, February 2006, DOT/FAA/TC-06/20, 182.

2. Bender, K., D'Avirro, J., Eyre, F., Marcil, I., Pugacz, E., Sierra Jr., E. A., *Human Visual and Tactile Ice Detection Capabilities under Aircraft Post Deicing Conditions*, FAA, February 2006, DOT/FAA/TC-06/21, 113.

3. SAE Aerospace Standard 5681, *Minimum Operational Performance Specification for Remote On-Ground Ice Detection Systems*, SAE International, September 2007.

4. Transport Canada Advisory Circular 602-001, *Operational Use of Remote On-Ground Ice Detection Systems (ROGIDS) for Post De-icing Applications*, April 2009.

5. Federal Aviation Administration Advisory Circular 120-107, *Use of Remote On-Ground Ice Detection System*, U.S. Department of Transportation, January 2011.

6. *Guidelines for Aircraft Ground Icing Operations*, Transport Canada, Montreal, April 2005, TP 14052E.

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APPENDIX A

TRANSPORTATION DEVELOPMENT CENTRE
WORK STATEMENT EXCERPT –
AIRCRAFT & ANTI-ICING FLUID
WINTER TESTING 2011-12

TRANSPORTATION DEVELOPMENT CENTRE
WORK STATEMENT EXCERPT –
AIRCRAFT & ANTI-ICING FLUID
WINTER TESTING 2011-12

3. DETAILED WORK DESCRIPTION

(Contract T8125-110167/001/TOR)

3.16.2 Support: Pre-Deicing, Engine, and Runway Threshold Ice Detection

a) Review previous work completed on detection of ice on aircraft surfaces at a location close to the runway threshold. In addition, investigate feasibility of using this technology for pre-deicing applications and engine applications (fan blades and cowlings);

b) Identify the limitations of current technologies for the specific applications. Evaluate option of using low-tech alternative to sensor (i.e. binoculars) to allow for initial procedural implementation in operations while technology is being further developed;

c) Participate with industry members to discuss the need to further investigate this area of study; It is anticipated that four meetings of two days will be needed with the work group to develop a test implementation plan;

d) Determine testing requirements for preliminary full-scale or flat plate testing based on the recommendations from industry meetings. These tests will be defined during the meetings. While it would be desirable to do testing outdoors in natural snow, testing in simulated indoor conditions may be less costly and more realistic due to time constraints on the equipment;

e) Develop methodology and procedure for indoor NRC testing;

f) Conduct testing at the NRC CEF. Eight days of testing are anticipated at the NRC facility. This will require one person for all conditions;

g) Analyze data and results; and

h) Report the findings and prepare presentation material for the SAE G-12 meetings.

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APPENDIX B

FLIGHT CREW SURVEY (CANADIAN VERSION)

Flight Crew Survey on Pre-Take-Off Contamination Inspections

In recent years there has been an increasing demand to find an alternative to the current methods used to perform pre-take-off contamination inspections. The SAE G-12 Aircraft Ice Detection Committee - with representatives from Transport Canada, the FAA, air operators, pilots and deicing service providers - is conducting a survey to gain a better understanding of the operational practices flight crews currently use to conduct these inspections.

We would be grateful if you could spend 5-10 minutes completing this survey so that we can learn from your operational experiences and gather your feedback on a new technology. Your participation will assist industry leaders and government regulators assess the potential advances in safety that could be gained by the development and operational approval of this technology.

NOTICE OF CONFIDENTIALITY: *This survey is being conducted confidentially. Your responses are anonymous and can't be linked to you.*

TECHNICAL SUPPORT: *For technical support please contact the Survey Administrator, Stephanie Bendickson, at sbendickson@telus.net.*

Instructions

Answer the questions that follow by clicking on the circle/box next to the appropriate response(s). Once you have answered all questions on a page, click the "next" button to go to the following page. You can go back to a previous question at any time by clicking the "back" button.

Click the "next" button below to start the survey

Pre-Take-off Contamination Inspections

Q1 Have you ever conducted a pre-take-off contamination inspection on your aircraft?

- ○ Yes
- ○ No

If "no" go to Q8

Q2 From where does your company (you or others) conduct pre-take-off inspections? Select any/all that apply.

- ☐ Cockpit / flight deck
- ☐ Cabin
- ☐ Outside the aircraft
- ☐ Other (specify below)

Other, specify:

Q3 What area(s) of the aircraft do you inspect when performing a pre-take-off contamination inspection? Please be as specific as possible.

Q4 Do any of the following impede your ability to conduct these inspections? Select any/all that apply.

- ☐ Inadequate lighting (night time visibility, insufficient artificial lighting)
- ☐ Cabin configuration (difficulty seeing wing due to location of passengers and cabin windows)
- ☐ No windows in cabin
- ☐ High wing configuration
- ☐ Large distances to wing tips
- ☐ Crazed windows
- ☐ Visibility impeded by winter precipitation
- ☐ Visibility impeded by de/anti-icing fluid
- ☐ Time constraints
- ☐ Uncertainty in what to look for
- ☐ None of the above

Q5 Are there any other factors that impede your ability to conduct these inspections?

Q6 Are you confident that the present method of performing pre-take-off contamination inspections can accurately determine whether contamination is present on the aircraft and that the deicing / anti-icing fluid is still effective?

- ○ Yes, very confident
- ○ Somewhat confident
- ○ No, not confident

Q7 To what extent does conducting a pre-take-off contamination inspection affect the flight crew?

- ○ Minimal disruption to workload
- ○ Slight disruption to workload
- ○ Excessive disruption to workload

Go to Q10 after answering Q7

Q8 Why don't you conduct these inspections?

- ○ Unfamiliar with this type of inspection
- ○ Inspections not possible in my aircraft type
- ○ Do not fly in winter weather conditions
- ○ Other

If "do not fly in winter weather conditions" go to end of survey

If "other" go to Q9

If "unfamiliar with this..." or "inspections not possible..." go to Q10

Q9 On the previous page you indicated "other" as the reason you don't conduct pre-take-off contamination inspections. Please describe the reason.

Repeat De/Anti-icing Operations

Q10 After being deiced and/or anti-iced and having departed the gate/pad/deicing centre, have you ever had to request a second de/anti-icing be conducted?

- ○ Yes
- ○ No

If "no" go to Q19

How many times you have had to request a second de/anti-icing for each of the reasons given below?

		Never	1	2	3	4	5	6-10	11-15	16-20	> 20
Q11	Holdover time expired	○	○	○	○	○	○	○	○	○	○
Q12	Flight crew OBSERVED contamination	○	○	○	○	○	○	○	○	○	○
Q13	Flight crew SUSPECTED contamination (i.e. flight crew unable to determine aircraft was clean)	○	○	○	○	○	○	○	○	○	○
Q14	Cabin crew / passenger reported contamination	○	○	○	○	○	○	○	○	○	○
Q15	Weather changed and take-off was deemed unsafe	○	○	○	○	○	○	○	○	○	○
Q16	Exceeded the requirement to become airborne within 5 minutes of contamination inspection	○	○	○	○	○	○	○	○	○	○

		1	2	3	4	5	6-10	11-15	16-20	> 20
Q17	Other (specify below)	○	○	○	○	○	○	○	○	○

Q18

Q19 How do you identify de/anti-icing fluid failure? This can be based on any training you have received and/or on your personal experience. Please select any/all that apply.

- ☐ Build-up of ice crystals in or on the fluid
- ☐ Loss of colour in fluid
- ☐ Buildup of snow on fluid
- ☐ Ice or slush in fluid
- ☐ Progressive surface freezing
- ☐ Dulling of surface reflectivity (loss of gloss)
- ☐ Other (specify below)

Other, specify:

Q20 Does your company provide training to help you identify when de/anti-icing fluids have failed?

- ○ Yes
- ○ No

If "no" go to Q23

Q21 Briefly describe the de/anti-icing fluid failure training you receive (i.e. pictures, descriptions, demonstrations, etc.)

Q22 Do you feel this training adequately prepares you to conduct an accurate de/anti-icing fluid failure inspection in operations?

- ○ Yes
- ○ No

Potential Use of ROGIDS

*Remote on-ground ice detection systems (ROGIDS) are currently being developed to check for ice during **post-deicing checks** (checks conducted immediately following deicing). Further development may allow the use of ROGIDS to replace the **pre-take-off contamination inspection** (ROGIDS equipment would be installed near the end of the runway).*

Q23 Assuming ROGIDS are proven to have the ability to accurately determine de/anti-icing fluid failure, would you support their use as an alternative to flight crews performing pre-take-off contamination inspections?

- ○ Yes, I would allow ROGIDS to replace my pre-take-off contamination inspection
- ○ Yes, I would use ROGIDS in conjunction with my pre-take-off contamination inspection
- ○ No, I would not support the use of ROGIDS for this application (please explain why below)

Q24 The information available from ROGIDS could be provided to flight crews in a number of ways. What do you think flight crews would prefer?

- ○ A go/no go system
- ○ A picture showing contamination on the examined part of the aircraft
- ○ Other (specify below)

Other, specify:

Q25 The development and regulatory approval of ROGIDS for this application may take several years. Do you have any suggestions for alternate methods/procedures/equipment that could improve the inspection process in the interim?

General

The following questions are for data categorization purposes. As stated previously, this survey is being administered confidentially and your responses can not be linked to you in any way.

Q26 Aircraft Types Flown:

Q27 Years of Commercial Flying Experience:

< 5 years	5-10 years	11-20 years	21-30 years	> 30 years
○	○	○	○	○

Q28 Approximate number of times you have been deiced or anti-iced in your career:

1-10	11-50	51-100	101-250	> 250
☐	☐	☐	☐	☐

Comments

Q29 Do you have any additional comments on the questions in the survey, pre-take-off contamination inspections and/or ROGIDS? Please use the space below to provide us with your feedback.

You have now finished the survey.
Click the "submit" button at the bottom of the page to submit your responses.

On behalf of the SAE G-12 Ice Detection Committee we would like to express our sincere appreciation for taking the time to complete our survey.

SAE G-12 Aircraft Ice Detection Committee Chair: Ed Pugacz (edward.pugacz@faa.gov)
FAA Representative: Ed Pugacz, FAA Tech Center (edward.pugacz@faa.gov)
Transport Canada Representative: Doug Ingold, Transport Canada Flight Technical (douglas.ingold@tc.gc.ca)
Survey Administrator: Stephanie Bendickson, APS Aviation (sbendickson@telus.net)

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APPENDIX C

FLIGHT CREW SURVEY (US VERSION)

Flight Crew Survey on Pretakeoff Checks and Pretakeoff Contamination Checks

In recent years there has been an increasing demand to find an alternative to the current methods used to perform pretakeoff checks and pretakeoff contamination checks. The SAE G-12 Aircraft Ice Detection Committee - with representatives from Transport Canada, the FAA, air operators, pilots and deicing service providers - is conducting a survey to gain a better understanding of the operational practices flight crews currently use to conduct these checks.

We would be grateful if you could spend 5-10 minutes completing this survey so that we can learn from your operational experiences and gather your feedback on a new technology. Your participation will assist industry leaders and government regulators assess the potential advances in safety that could be gained by the development and operational approval of this technology.

NOTICE OF CONFIDENTIALITY: *This survey is being conducted confidentially. Your responses are anonymous and can't be linked to you.*

TECHNICAL SUPPORT: *For technical support please contact the Survey Administrator, Stephanie Bendickson, at sbendickson@telus.net.*

Instructions

Answer the questions that follow by clicking on the circle/box next to the appropriate response(s). Once you have answered all questions on a page, click the "next" button to go to the following page. You can go back to a previous question at any time by clicking the "back" button.

Click the "next" button below to start the survey

Pretakeoff Checks / Pretakeoff Contamination Checks

Q1 Have you ever conducted a pretakeoff check and/or pretakeoff contamination check on your aircraft?

- ○ Yes
- ○ No

If "no" go to Q8

Q2 From where does your company (you or others) conduct pretakeoff checks / pretakeoff contamination checks? Select any/all that apply.

- ☐ Cockpit / flight deck
- ☐ Cabin
- ☐ Outside the aircraft
- ☐ Other (specify below)

Other, specify:

Q3 What area(s) of the aircraft do you inspect when performing pretakeoff checks / pretakeoff contamination checks? Please be as specific as possible.

Q4 Do any of the following impede your ability to conduct these checks? Select any/all that apply.

- ☐ Inadequate lighting (night time visibility, insufficient artificial lighting)
- ☐ Cabin configuration (difficulty seeing wing due to location of passengers and cabin windows)
- ☐ No windows in cabin
- ☐ High wing configuration
- ☐ Large distances to wing tips
- ☐ Crazed windows
- ☐ Visibility impeded by winter precipitation
- ☐ Visibility impeded by de/anti-icing fluid
- ☐ Time constraints
- ☐ Uncertainty in what to look for
- ☐ None of the above

Q5 Are there any other factors that impede your ability to conduct these checks?

Q6 Are you confident that the present method of performing pretakeoff checks / pretakeoff contamination checks can accurately determine whether contamination is present on the aircraft and that the deicing / anti-icing fluid is still effective?

- Yes, very confident
- Somewhat confident
- No, not confident

Q7 To what extent does conducting these checks affect the flight crew?

- Minimal disruption to workload
- Slight disruption to workload
- Excessive disruption to workload

Go to Q10 after answering Q7

Q8 Why don't you conduct these checks?

- Unfamiliar with this type of check
- Checks not possible in my aircraft type
- Do not fly in winter weather conditions
- Other

If "do not fly in winter weather conditions" go to end of survey

If "other" go to Q9

If "unfamiliar with this..." or "inspections not possible..." go to Q10

Q9 On the previous page you indicated "other" as the reason you don't conduct pretakeoff checks / pretakeoff contamination checks. Please describe the reason.

Repeat De/Anti-icing Operations

Q10 After being deiced and/or anti-iced and having departed the gate/pad/deicing center, have you ever had to request a second de/anti-icing be conducted?

- ○ Yes
- ○ No

If "no" go to Q19

How many times you have had to request a second de/anti-icing for each of the reasons given below?

		Never	1	2	3	4	5	6-10	11-15	16-20	> 20
Q11	Holdover time expired	○	○	○	○	○	○	○	○	○	○
Q12	Flight crew OBSERVED contamination	○	○	○	○	○	○	○	○	○	○
Q13	Flight crew SUSPECTED contamination (i.e. flight crew unable to determine aircraft was clean)	○	○	○	○	○	○	○	○	○	○
Q14	Cabin crew / passenger reported contamination	○	○	○	○	○	○	○	○	○	○
Q15	Weather changed and takeoff was deemed unsafe	○	○	○	○	○	○	○	○	○	○
Q16	Exceeded the requirement to become airborne within 5 minutes of contamination check	○	○	○	○	○	○	○	○	○	○

		1	2	3	4	5	6-10	11-15	16-20	> 20
Q17	Other (specify below)	○	○	○	○	○	○	○	○	○

Q18

Q19 How do you identify de/anti-icing fluid failure? This can be based on any training you have received and/or on your personal experience. Please select any/all that apply.

- ☐ Build-up of ice crystals in or on the fluid
- ☐ Loss of color in fluid
- ☐ Buildup of snow on fluid
- ☐ Ice or slush in fluid
- ☐ Progressive surface freezing
- ☐ Dulling of surface reflectivity (loss of gloss)
- ☐ Other (specify below)

Other, specify:

Q20 Does your company provide training to help you identify when de/anti-icing fluids have failed?

- ○ Yes
- ○ No

If "no" go to Q23

Q21 Briefly describe the de/anti-icing fluid failure training you receive (i.e. pictures, descriptions, demonstrations, etc.)

Q22 Do you feel this training adequately prepares you to conduct an accurate de/anti-icing fluid failure check in operations?

- ○ Yes
- ○ No

Potential Use of ROGIDS

*Remote on-ground ice detection systems (ROGIDS) are currently being developed to check for ice during **post-deicing checks** (checks conducted immediately following deicing). Further development may allow the use of ROGIDS to replace **pretakeoff checks and pretakeoff contamination checks** (ROGIDS equipment would be installed near the end of the runway).*

Q23 Assuming ROGIDS are proven to have the ability to accurately determine de/anti-icing fluid failure, would you support their use as an alternative to flight crews performing pretakeoff checks / pretakeoff contamination checks?

- ○ Yes, I would allow ROGIDS to replace my current checks
- ○ Yes, I would use ROGIDS in conjunction with my current checks
- ○ No, I would not support the use of ROGIDS for this application (please explain why below)

Q24 The information available from ROGIDS could be provided to flight crews in a number of ways. What do you think flight crews would prefer?

- ○ A go/no go system
- ○ A picture showing contamination on the examined part of the aircraft
- ○ Other (specify below)

Other, specify:

Q25 The development and regulatory approval of ROGIDS for this application may take several years. Do you have any suggestions for alternate methods/procedures/equipment that could improve the inspection process in the interim?

General

The following questions are for data categorization purposes. As stated previously, this survey is being administered confidentially and your responses can not be linked to you in any way.

Q26 Aircraft Types Flown:

Q27 Years of Commercial Flying Experience: ○ ○ ○ ○ ○

Q28 Approximate number of times you have been deiced or anti-iced in your career: ☐ ☐ ☐ ☐ ☐

Comments

Q29 Do you have any additional comments on the questions in the survey, pretakeoff checks / pretakeoff contamination checks, or ROGIDS? Please use the space below to provide us with your feedback.

You have now finished the survey.
Click the "submit" button at the bottom of the page to submit your responses.

On behalf of the SAE G-12 Ice Detection Committee we would like to express our sincere appreciation for taking the time to complete our survey.

SAE G-12 Aircraft Ice Detection Committee Chair: Ed Pugacz (edward.pugacz@faa.gov)
FAA Representative: Ed Pugacz, FAA Tech Center (edward.pugacz@faa.gov)
Transport Canada Representative: Doug Ingold, Transport Canada Flight Technical (douglas.ingold@tc.gc.ca)
Survey Administrator: Stephanie Bendickson, APS Aviation (sbendickson@telus.net)

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APPENDIX D

ASRS REPORTS RELATED TO AIRCRAFT GROUND DEICING (WITH POTENTIAL FOR PREVENTION WITH ROGIDS APPLICATION)

18 ACN: 765422

Incident Type:	Failure to Deice
ROGIDS Application:	End-of-Runway
Synopsis:	Emb135 departed without deicing while light freezing rain was being reported on atis.
Narrative:	I was acting as fo on a scheduled part 121 operated flt from stl arpt. While the capt was tending to his preflt duties, i tended to getting atis, clrnc, and calculating the wt and bal. Afterwards we completed a briefing of current conditions at dep and proposed arr arpts. After doors had been closed and the necessary chklists had been completed, i called for push and taxi from their respective freqs. While taxiing out of the non movement area, gnd-metering advised us to pick up the most recent atis. While listening, the capt and i neglected to hear the light freezing rain existence on the field due to freq congestion and continued toward the dep rwy as usual. After departing the terminal area, the capt turned on atis again questioning what had been previously noted, and realized the freezing rain and our situation of not being deiced and anti-iced as per our general ops manual. Prior to our dep, our separate duties to chk the acft ctl surfaces and verify the proper settings for eng and airframe anti-ice selectors, which were both on due to current arpt conditions as observed from the cockpit had been completed. I do realize why the situation escalated into what it did, this flt was my second flt ever experiencing temps below freezing before tkof. All my flt training was conducted in temps above freezing. The previous day was my first day experiencing freezing conditions. At the time i had read all the company memos, however, had not had any experience, so it did not register. I have then since read over the memos again and with my experience have understood them better. The capt and i discussed the situation and i fully understand the severity of the situation and can assure that this mistake will never recur. The tkof and flt were completed with no further occurrences, however, we realized the situation and learned from our mistakes and fully intend to pay better attn in the future.

62 ACN: 534476

Incident Type:	Failure to Deice
ROGIDS Applications:	Pre-Deicing, End-of-Runway
Synopsis:	B777-200 fo was intimidated to depart by company chief plt and capt after she informed them there was ice adhering to the acft and wings.
Narrative:	In this event, i felt our acft (a b777) needed deicing/anti-icing. The capt did not. Because i was insistent, he summoned my assistant chief plt, who claims he inspected the acft (but later he admitted he did not see the trailing edges of the wings nor other wing-mounted ctl surfaces) and told me that he agreed with the capt and that we should take the acft without deicing. The events in chronological order: i arrived at the acft about 1 hr prior to scheduled pushback. After performing the interior inspection and cabin preflt, i did the exterior walkaround. It had begun to snow and the outside air temp was 31 degs f. Although the parts of the acft visible from the gnd and from the cockpit showed no sign of ice or snow, an inspection of the wings from the pax cabin proved otherwise. On the entire trailing edge of both wings, including on the ailerons, flaperons, and trailing edge flaps, an earlier deicing attempt had apparently resulted in its residue freezing fast to the down side of the wings. The residue was not liquid -- it was very definitely frozen -- into long (and sometimes wide) areas of finger-shaped drips. Not only that, but the snow was gradually adhering to these frozen spots, making them thicker. I pointed this out to the apt and he flatly refused to deice. I tried to look up the reg and realized i'd left the appropriate volume out of my flt kit, as i'd only the day prior had it out of my bag. I obtained another copy of it prior to flt but the delay in doing so, coupled by the capt's insistence that i load the fms (about a 15-min process, since it was a short flt) kept me from being able to seek support from other auths. At pushback time the capt and assistant chief plt were waiting for me in the jetway. Because i was certain the acft would fly (it was cold, a large headwind was predicted and we were very light) i agreed to fly this flt, without deicing. Although the rest of the flt was uneventful, i felt we should have deiced like the vast majority of other flts did. I also felt the pressure from mgmnt to fly under these conditions was wrong.

59 ACN: 537082

Incident Type:	Failure to Deice
ROGIDS Application:	End-of-Runway
Synopsis:	Ice accumulated on the inbound leg is removed. After the subsequent dep an acr observer claims de-ice holdover procs were not compiled with
Narrative:	Upon arr into sux, flt xxxx, i determined that it would be necessary to de-ice the acft, to remove the ice buildup from the inbound flt. I also determined that no precipitation (rpted light snow) was adhering or accumulating to the airframe, therefore, i did not initiate a 'gnd icing program.' holdover time considerations were not applicable under these specific conditions, in accordance with airline's winter ops/gnd icing program. After we had been deiced with type 1, to remove the accumulated ice from the inbound flt, we (the fo and i) determined that the acft was free of any snow, frost or ice, via a visual inspection from the cockpit and taxied out. All this was accomplished under normal conditions (at no time did we enter gnd icing conditions). After taxiing to the end of the rwy and performing a precautionary tkof chk, i determined that it was safe to take off and continue to stl in compliance with far 91.527 and far 121.629. Holdover times were unnecessarily xmitted from station op while inflt, although they were neither requested nor required. An faa inspector onboard, riding on the observation seat, questioned the deicing proc and holdover time after we departed sux. I believe that no proc, rule or reg has been broken or overlooked at sux, during deicing and tkof. Supplemental info from acn 536890: under our company winter ops icing program there are 2 programs under which we operate, normal and gnd icing. Normal requires only type 1 and does not require compliance with holdover charts. We were operating under this normal program. The faa inspector on board said we exceeded our holdover time and took off in violation.

61 ACN: 535551

Incident Type:	Failure to Deice
ROGIDS Application:	Pre-Deicing, End-of-Runway
Synopsis:	Lcl ctlr at crw during a snow storm received request from an emb135 and later from an emb 145 for taxi clrnc tot he rwy for tkof. Both acft were heavily covered with snow and skipped deicing.
Narrative:	I was working lcl ctl, gnd ctl, and radar combined in the twr on the morning of 01/sat/02 during a snowstorm. All the acft, approx nine, on the main ramp were covered with snow except for a covered acft that was in the middle of deicing. To my surprise an emb 135 pax jet to cle, called for taxi. I questioned the plt as to his loc and to see if he wanted to repos the acft or taxi for tkof. The plt informed me he was requesting to taxi for tkof. I asked the plt if he was aware that his acft appeared not to have been deiced. The fuselage was covered with 3 to 4 inches of snow, the markings on the side of the acft was unreadable due to the snow, aft pax windows were partly covered with snow that was overflowing from the fuselage, the nose was covered with snow, and the left horizontal stabilizer (the only one clearly visible from the twr) had several inches of snow buildup. The plt informed me that he was advised that acft was clr! Approx 20 mins later an emb 145 pax jet to pit, requested to taxi for tkof. The acft had been deiced earlier however new snow had lightly covered the wings and fuselage. The first third of the left inboard wing had enough accumulation that the wing was not visible. The local ctlr advised the plt however he continued to taxi and departed about 10 to 15 mins later. Due to the visibility the acft was out of site during this time and it was impossible to see how much more snow had gathered on the wings. During the last snow storm at yeager arpt the same sit occurred with pax acft requesting to taxi with large amounts of snow and ice on their acft. All the acft taxied back due to notices from the twr or ice warning lights in the cockpit. The nonchalant attitude to deicing has me concerned. I do not feel it should be the twr's responsibility to monitor acft deicing, however i feel we must. If the twr visibility was a little lower we would not have been able to see emb 145 and he would have attempted to depart was considerable amount of snow on the acft at an arpt on a 6302 ft rwy.

22 ACN: 764827

Incident Type: Failure to Identify Contamination

ROGIDS Applications: End-of-Runway, Pre-Deicing

Synopsis: A b737 plt perceived the wings free of ice before tkof and therefore did not de-ice. Deadheading plts rpt significant wing ice at tkof.

Narrative: Conducted normal preflight. I included a brief exterior inspection upon arr at gate as fo arrived just after due to late arriving deadhead flt. Pushed late after fairly expeditious boarding. Nothing significant on taxi out. Fo and i conferred about need to de-ice or not. Both concluded the need did not exist based on visual inspections, rpted temperature, and the fact that there was no observable accumulation of precipitation. Departed approx 15 minutes after pushback on rwy 27l, and flt was completely uneventful. Supplemental info from acn 764642: after arriving at the acft i conducted the preflt exterior inspection. There was a light dusting of snow on the top of the fuselage, nose, and engine cowling. I could not get a good look at the top of the wings from the gnd. I don't know if the capt chked the wings from the emer exit windows (he might have). There was some conversation between the capt and flt attendant about deicing but i don't remember when. I was busy and really don't know what it was about. We taxied out and noticed some acft were deicing and some weren't. With the new atis, the temperature had risen to above freezing, the windows and nose were clean. We both looked outside at the wings and they looked clean. We agreed the acft did not require deicing. We took off without incident. I should have chked the top of the wing from the over wing exits. I should have asked the capt if he chked the wings. If any other employee had concerns, they should have brought it to the capt's attention prior to takeoff. Supplemental info from acn 764639: i was a deadheading crewmember on flt from zzz. Got onboard without seeing the capt and proceeded to rear of acft. Sat next to window (with other deadheading plt in row behind me next to window also). Noticed there was light snow falling, with some accumulation on windows as well as the wings. The other plt and i talked about the de-ice location in zzz as i had not de-iced there before. Taxied out rather briskly, with both of us assuming we're going to the de-ice pad. After a bit of taxiing, we hear the flt attendant 'chime' for takeoff and the power increasing for takeoff. I turned around in my seat and said to the other plt, 'we're taking off?' at liftoff, the snow/slush on the front half of wing slid off. Clbout brought maybe 2/3 of snow/slush off of the back half of the wing. The last 1/3 of remaining snow slowly dissipated in cruise. After lndg, we spoke to capt in the jetway about deicing in zzz and the amount of snow on the wings. He stated that it was above freezing and that we didn't need to de-ice. I told him i'd never seen that much snow on the wings and that i didn't know the airplane would even fly like that. We told him that the pax and flight attendants were very concerned and we walked off trying to make sense of what just happened. Later on in the terminal while we were waiting for our inbound flt, capt apched me and asked exactly what i'd seen on the wings. I told him it was a lot of snow and that we thought certainly he was going to de-ice, and then before we knew it, we were taking off. He reiterated that it was above freezing and that he didn't think he needed to de-ice. Supplemental info from acn 764644: i was a deadheading crewmember on flt from zzz. I boarded the acft and sat on the fo's side two rows from the rear. It appeared to me that it was snowing at the time of boarding as the wing was partially covered with approx 1/4 inch of snow mixed with what appeared to be slush. I might point also that the window i was looking out of was partially obscured with snow and ice.

64 ACN: 496272

Incident Type:	Failure to Identify Contamination
ROGIDS Application:	Pre-Deicing, End-of-Runway
Synopsis:	Md80 crew allegedly took off with snow adhering to the leading edge of the wings and upper fuselage.
Narrative:	After conducting a walkaround, i advised the capt that there was snow adhering to the leading edge of the wings and upper surface of the fuselage. Since the wing heater was inop, the capt requested i obtain ladders to chk if the tufts on the wing were frozen -- they were not. However, light snow covered the wing area with a buildup of snow on the leading edge that extended back on the wing about 8 inches. I advised the capt what i saw and he said that he had observed that the snow on the leading edge was easily brushed off. He said, 'we don't need to deice, what do you think?' i said i thought we did need to deice. He then said that, 'at this temp adding hot water will only make this stuff freeze.' i replied that is what glycol was for, but the capt did not reply. Once i wa back in the cockpit, i contacted metering to chk for delays. While i was waiting for release, the deice crew called. I advised the capt that the deice crew was ready to deice the acft and they wanted to i know what type fluid to use. It was 19 degs f with light snow. The capt radioed the deice crew that he did not wish to be deiced. He stated that there was nothing adhering to the acft. After receiving clrnc to push, the push crew called and they too asked if we were going to deice, and the capt said no. We were disconnected from the tow bar, taxied out and departed without incident.

68 ACN: 493770

Incident Type:	Failure to Identify Contamination
ROGIDS Application:	Pre-Deicing, End-of-Runway
Synopsis:	B757 crew, operating in snow, had a pax point out that the acft needed deicing in pit.
Narrative:	Concerned about the wx (10 sm, snow, 070 ovcst, 1 mi visibility) both the capt and fo chked the wings for contamination from the cabin at the gate prior to boarding. In addition, the fo did the required predep acft chk during his walkaround. We both concluded the acft was clean. After discussion, the current wx conditions and consulting a company provided de-icing/anti-icing flow chart we determined that deicing would not be necessary. When we were #1 for tkof, a flt attendant called the cockpit to rpt that a company employee traveling as a pax and familiar with deicing procs and requirements had determined that the wings were contaminated and that the acft required deicing. We decided to go to the deice pad and request an external inspection by deicing personnel. Deicing personnel determined that a type i wash was needed. It is widely recognized that some kinds of contamination are nearly impossible to detect from the grazed window in the cabin. This event underscores the point. Needless to say, good proc mandates an external inspection whenever wx conditions are questionable.

59 ACN: 541519

Incident Type: Failure to Identify Contamination

ROGIDS Applications: Pre-Deicing, End-of-Runway

Synopsis: A b757-200 deadheading company capt pointed out that the acft wings were contaminated with frost. This occurred on taxi to the rwy.

Narrative: Frosty wings. A sunny, clr, yet cold morning for dep from zzz. A special qualification city in mountainous terrain. No special reason for concern about the condition of the acft or my fo, with whom i have enjoyed a good month of trouble-free flying. Normal sequence of events in preparation for start, taxi, etc, until a cabin call came to the cockpit. A fellow deadheading company plt, riding in main cabin rpted through one of our flt attendants that there was frost prevalent on the top surfaces of both wings. I decided immediately to return to the ramp for deicing. Atc, station personnel, and pax were advised of the circumstances and our intentions as we returned for deicing. A zzz ramp agent and a deicer guided us to a ramp-side deicing pad for deicing with type i fluid. Once complete, we restarted engs, and resumed taxi out and a subsequent normal, uneventful tkof into a beautiful rocky mountain morning. The fo is a diligent professional. I'm confident in his ability and performance. This morning, however, the coffee just wasn't doing the trick, and he admittedly failed to adequately confirm that the wings were clean. Temp was several degs below freezing, although the air was relatively dry. No evidence of frost was present on the undersides of the wings, so he concluded the tops must also be frost-free, without actually having examined the upper wing surfaces. If a glance back from the rear of the acft had been made during the walkaround, the frost would have been spotted, and deicing would have been called for prior to taxi out. Besides the opportunity for frost detection during the normal exterior walkaround sequence, a good practice to alleviate the risk of such an embarrassing and possibly critical oversight as this may be to make a habit of chking wing surfaces from within the cabin in the case of preflt in such freezing conditions. I, too, should simply make it a habit to maintain a degree of skepticism about the possibility of ice or frost on the acft whenever an acft has been overnight at sub-freezing temps. I'll ask rather than assume. My query during cockpit preparations may have prompted one more chk which would have revealed the contaminated wings. Many thanks to non-revenuing capt for his intervention. His input spared us from making a tkof with contaminated wings.

30 ACN: 729323

Incident Type:	Failure to Identify Contamination
ROGIDS Application:	End-of-Runway
Synopsis:	An a 320 pilot reports tkof with ice pellets and snow falling but without a de-ice/holdover checklist to cover the existing conditions.
Narrative:	We de-iced at the gate due to light ice pellets and moderate snow. According to the de-ice form/chklist we use, you must use type 4 fluid for any ice pellets and tkof must begin within 25 mins of the start of the type 4 application. It took the de-ice crew 19 mins to de-ice with type 4, so we only had 6 mins to meet the holdover time. The other prob was that there are no charts for holdover times for mixed precip (ie, ice pellets and snow). So we were not legal as there was no holdover time published for the mixed precip. Capt said it appeared to only be snow falling, even though atis record specials kept rpting ice pellets and snow. We met the holdover time for the ice pellets, but should have waited for precip to change to one or the other so we could appropriately meet the holdover time for the type of icing rpted. I told the capt we should not take off and delay or have the company cancel the flt as we were at the beginning of a large winter storm apching chicago. He said 'we are going -- if we wait, we will never get out of here.' i objected, but he elected to continue anyway and tkof. Biggest factor -- get-homeitis by capt. 2nd factor -- inability to understand new de-ice chklist/holdover times. 3rd factor -- inadequate training of new fom. 4th factor -- inability of capt to accept suggestions from his crew.

66 ACN: 494980

Incident Type:	Difficulty Identifying Contamination
ROGIDS Applications:	Pre-Deicing, Engine Icing
Synopsis:	A b727-200 fo inadvertently deploys the l aft galley door evac slide when opening it to chk for ice accumulation in the #1 eng at the ramp in dfw, tx.
Narrative:	At the gate at dfw, during freezing rain and ice pellets, deicing was not available at the gate and i was concerned about ice ingestion to the engs. Just prior to pushback, i asked the fo to go back in the cabin to chk for ice buildup in the eng inlets. He didn't realize the slide was armed and it inflated upon opening the l aft galley door. Supplemental info from acn 494979: after returning to the gate for maint, this all happened after numerous distrs and delays. Supplemental info from acn 494981: assuming that the slide was still unarmed from a previous inspection, i opened it without verifying that the inflatable exit slide was unarmed.

10 ACN: 780689

Incident Type:	Difficulty Identifying Contamination
ROGIDS Application:	Pre-Deicing
Synopsis:	Captain of unknown acr acft type reports gnd crew's attempt to circumvent his request for de-icing prior to dep.
Narrative:	Outside air temp +2 degs c. On arr to gate, both my fo and i noticed that the acft was covered in frost. An overwing inspection confirmed the presence of frost on the wings, so i called maint for a deicing after pushback. A mech came up to the acft to inform me that there was only 'moisture' on the wings. In doubt of this, i went down to inspect the wings for myself. On a ladder and with an ice chk wand, i confirmed the presence of the still-existing frost. I could clearly see the scrape lines in the frost made by the wand. I asked the mech who was still standing there to chk for himself, which he did and told me that it was only moisture. I told him we would need a deicing before dep. Maybe better training for the 'ice checkers.'

50 ACN: 575009

Incident Type:	Difficulty Identifying Contamination
ROGIDS Application:	Pre-Deicing
Synopsis:	During preflt, a plt has an inadvertent activation of airbus 319 over wing escape slides when opening the exit to inspect for ice accumulation on the wing.
Narrative:	During preflt inspection, i noticed a large amount of clr ice on acft surfaces. After completing a walkaround inspection, i wanted to view the upper wing surfaces from an overwing exit for ice. Not being able to see clrly through the emer exit cabin window, i thought that opening the exit door would give me a much clrer view of the amount of ice on the wings. I hesitated for a moment to question if acft had overwing escape slides. I then viewed emer placards on door for pictures of slides and use in an emer, and none were placarded on this acft. I then asked my b flt attendant if this acft has emer wing escape slides, and she said no (i said are you sure?), she said let me chk with the other 2 flt attendants on board, they also said 'no' to acft having escape wing slides. I then opened the r wing emer exit door and the slide deployed.

7 ACN: 816184

Incident Type:	Difficulty Identifying Contamination
ROGIDS Application:	Pre-Deicing
Synopsis:	An A320's right wing inspection/scan light was inoperative during night and snow operations. The MEL prohibits release under these conditions, yet until the flight crew refused the aircraft, Maintenance was not inclined to repair the light.
Narrative:	During preflight inspection, First Officer discovered right wing inspection/scan light inoperative. Captain called Maintenance Control via telephone and verbally informed them of issue. After arriving in the cockpit, a new Maintenance Release printed with no reference to wing light inoperative. Captain immediately sent Maintenance code via ACARS. Approximately 10 minutes later, Captain called Maintenance to ask about wing light repair. Maintenance Control informed Captain the issue would be deferred. I, the Captain, then informed him that I did not think it could be deferred given the conditions: night and snowing. He said he would review the MEL and get back with me. After approximately 5 minutes, we received an ACARS message from Dispatcher asking 'are you agreeable to go with the right wing scan light inoperative.' We replied, 'Negative.' During this, we received another Maintenance Release with the item deferred and an MEL printout stating, 'B. both lights must be operative for night operations where wing visual inspections are required.' How could a Maintenance Controller AND a Dispatcher each review the MEL item and defer this item on a snowy night? Additionally, we called and informed Maintenance that the item would need to be repaired. A Mechanic arrived in the cockpit and asked us if we were refusing aircraft. I said that we were not refusing the aircraft, but felt that an item had been deferred that could not be deferred given the conditions. He again asked us if we were refusing the plane. I stated if that was what was necessary to have the light repaired, then yes, we were refusing the aircraft. He promptly exited the plane. Soon 2 other Mechanics arrived and promptly and professionally replaced and tested the right wing scan/inspection light. I think this was an attempt to illegally defer an item. I don't see how, after verbally being told that the item could not be deferred given the conditions, Maintenance could review and sign off/defer an item that clearly states the above quoted restriction.

4 ACN: 820711

Incident Type:	Ice in Engines
ROGIDS Application:	Engine Icing
Synopsis:	A B737 pilot notes large amounts of ice and snow in both engine's inlets during preflight. The ice had frozen the fans and ground air was used to thaw the ice where de-ice fluid may damage engine components.
Narrative:	There were 2 unsafe conditions -- significant ice left in engines and potentially incorrect procedures to remove the ice. During walkaround preflight, I found a huge amount of loose ice chunks lying inside the #2 engine cowl. After 3 or 4 sweeps of my entire arm clearing the FOD, I then started to clear the smaller chunks. At this time I noticed a large amount of clear ice that obviously was puddle water which had frozen (about a Frisbee size) to the bottom of the intake. In addition, the fan blades had significant clear ice on them too. Both of these areas were frozen solid and could not be removed by hand. The #1 engine cowl and fan was in similar condition with un-removable frozen ice but had less 'loose' chunks than #2. I cleared both engines out as best I could and informed the Captain with a suggestion to call Maintenance. He decided to rather call Iceman and have them deal with it, suggesting to me that they spray fluid in the engines. I mentioned this was a bad idea and potentially damaging. At the same time, we overheard another crew ask Iceman for the very same thing -- wanting to have deicing fluid in the engine. Iceman was smart enough to know this was not correct and sent for a Supervisor. The Supervisor correctly guided us and the other crew to have PC air used to melt the ice. No further problems were noted at this point. First, there is no excuse to have an originating aircraft be left in such poor condition at a Maintenance Base. I hazard to guess the engine covers were partially to blame and may have contributed to the ice build-up if incorrectly installed. The Ground Crew removing them were extremely negligent in my opinion as there was no regard to the condition in which the engines were left. Second, crews do not seem to know that deicing fluid is potentially very damaging to the engines. This point needs to be made clearly somewhere in the vast sea of FOM procedures. Luckily, Iceman was trained well enough to not allow this to happen. ZZZ is a fairly large Maintenance Base but what scares me is the smaller stations with less experience combined with a crew's poor remedy in this same situation. Significant ice build-up and FOD inside engine cowl found during preflight.

27 ACN: 735255

Incident Type:	Ice in Engines
ROGIDS Application:	Engine Icing
Synopsis:	An md88 captain expresses concern regarding de-icing procedures and atc braking action reporting at syr.
Narrative:	When we arrived at the acft, it was snowing heavily. It was dark and visibility was very poor. I asked a ramp worker, whom i encountered in the jetway, if they were going to deice the area around the eng inlets before we taxied to the deice pad. It was clr from his expression that my question was completely unexpected. He said they have never done that and were in fact prohibited from doing any deicing at the gate. All deicing has always been done in the deice pad. We had a lot to think about. There was a 23 kt xwind and the braking action was being rpted as poor. Poor braking limits us to a 20 kt maximum xwind. After speaking with flt ctl it was decided that we should wait until xa:00. By then the wind was expected to shift westerly allowing us to tkof. We then discovered that the mu readings were 30/35/20. An mu reading of 20 equates to nil braking. I was surprised to learn that the twr can call the braking poor by vehicle when the vehicle readings were actually fair, poor and nil. We insisted the rwy be plowed again and braking action be rechked. Eventually, we pushed back and started the l eng. After the eng stabilized at idle, we turned on the eng anti ice. A few seconds later the eng momentarily rolled back 2% n2 and recovered. When i advanced the throttle to close the surge valve the eng again momentarily rolled back 2% n2. These rollbacks were very brief and the eng remained smooth. I suspected that the eng swallowed a slug of water as snow melted. We taxied to the deice pad. At the pad we saw several acft with snow in their intakes. Deice at syr is performed with the engs not operating. The intakes are cleaned as part of the deice process at the pad. One rj on the pad experienced an apu flameout when the deice crew blew a chunk of snow off their tail and into the apu inlet.

28 ACN: 734481

Incident Type:	Ice in Engines
ROGIDS Application:	Engine Icing
Synopsis:	Md80 capt rpts nose gear strut svcing prob. He also reports that ice, shed from the acft nose during clb out, was possibly ingested into the engs, causing damage.
Narrative:	Two items which have been of interest on the md80 fleet were observed on this flt. On arr, i noticed that the nose gear seemed to be bottoming out on even the smallest cracks on the txwy surface. I asked maint to inspect the nose gear in between flts. They found the strut low, and i could visually see that it was on preflt. First attempts to service the strut failed, as the seal had apparently 'rolled.' after maint was performed on the strut it then took nitrogen, and maint signed the acft off for svc and notified maint ctl for follow up svcing. I would encourage all crews to have any suspect struts inspected, as according to the tech i spoke with, an improperly svced strut could lead to a failure of the nose gear to retract. On dep, a moderate amount of mostly clr ice was encountered during clb out. All anti-icing procs were followed in accordance with the operating manual. After exiting the icing conditions and flying into noticeably warmer air, i noticed some of the ice break off the wipers in pieces rather than melt or sublimate off as icing usually does. I was busy at this time in the clb, but later at cruise i contemplated whether icing breaking off the airframe could be ingested in the engines. On arr, i requested a precautionary inspection of the engine inlets. On later follow up on these two write-ups, i was told that a very small, blendable nick was found on a blade on each engine. According to the tech, the nicks could have been caused by icing, or they could have already been there for some time. It might be prudent after flying through moderate or severe icing conditions where the icing is observed to rapidly shell off the acft to have a precautionary look at the engine intakes on arr.

29 ACN: 734157

Incident Type:	Ice in Engines
ROGIDS Application:	Engine Icing
Synopsis:	A ba-3200 flt crew started engines with snow and ice contamination in the engines. Several legs later, bent compressor blade was discovered by maintenance personnel.
Narrative:	I conducted a preflt chk of our acft. I never spun the props by hand. After the acft was deiced with type 1 fluid, an eng start was attempted. Eng rotation was never achieved and the start was aborted. My capt and i determined that the engs were filled with snow and ice and contacted our company's maint dept. Maint instructed us to have the engs preheated. The engs were preheated, the #2 eng being thawed first. The capt started the #2 eng without incident, all eng indications were normal. Shortly thereafter the #1 eng was started without incident, all eng indications were again normal. Approx 10 mins after the #1 eng was started the capt brought both engs into reverse to take them off of the start locks. Shortly after this the #1 eng experienced a flameout. The wx at this time was driving snow and there were many pieces of ice on the gnd around the acft. The capt called company maint and was told to attempt a restart on the #1 eng. Eng #1 was restarted without incident. Eng #1 indications were all normal. The flt departed zzz and went on to zzz1 and from there on to zzz2 all without incident and with normal eng indications. At zzz2 company maint determined that one of the stage 1 compressor blades was bent on eng #1. Actions that could have prevented the above incident include: 1) using the eng plugs whenever the acft is left outside. 2) always spinning the props on preflt to determine that they will rotate on eng start. 3) chk the general ramp area for debris that could potentially get sucked into the eng intake. 4) company should provide some sort of step ladder so that those of us that are not tall can actually see into the eng intake for the preflt inspection.

40 ACN: 644722

Incident Type:	Ice in Engines
ROGIDS Application:	Engine Icing
Synopsis:	An md80 on tkof roll aborted tkof at 110 kts due to compressor stall. Returned to gate and discovered l eng fan blades damaged.
Narrative:	During tkof roll at zzzz, we experienced compressor stalls on the l eng. We successfully aborted the tkof at approx 110 kts. Rwy was clean with about a 10 kt xwind and some blowing snow. Taxied back to gate and shut down engs for maint inspection. Maint discovered some fan blade damage on the l eng. The acft had arrived the night before and was towed to the gate for our flt. There had been hvy snow and below freezing temps throughout the night. The storm had passed leaving clr, vmc and cold temps. During my walkaround, i noticed the wings were contaminated with snow and ice. I inspected the eng inlets and nacelles from the gnd and did not see any eng contamination. After pushback and eng start, we taxied to the deicing pad at zzzz. We were deiced and inspected by gnd personnel and then taxied directly to the rwy for tkof. All eng insts had normal indications from run-up through tkof roll.

42 ACN: 636478

Incident Type:	Ice in Engines
ROGIDS Application:	Engine Icing
Synopsis:	A b737-700's engs accumulated fan blade ice during taxi and extended hold for rvr improvement in dense fog and freezing temps.
Narrative:	Prior to pushback preflt indicated need for deciding due frost. Temp was -1 deg c dew point -1 deg c. Visibility was initially rpted as 1/4 mi. After deicing and during taxi to rwy 3, visibility dropped to 600-800 ft rvr. Twr clred us into pos and hold on rwy 3 and said 'rvr 600 ft.' further inquiry revealed mid rvr to be 500 ft. Now clred into pos and hold while waiting for rvr to improve. Holdover time of approx 17 mins was now exceeded. I (fo) went back to perform contamination chk. No contamination. Shortly after i was again seated, we both noticed a slight vibration. All eng parameters appeared normal. Capt started to run up engs for clring proc and thought better of it at approx 40% n1. Capt and i discussed it further and decided to return to gate suspecting fan blade icing. After returning to gate inspection showed 1/4 to 3/8 inch of ice on both fan and stator as well as considerable build up of ice on the back of fan blades. Contacted maint ctl and dispatch. Mechs heated the engs with conditioned air units and after another deicing of the airframe we departed with no further probs.

44 ACN: 642026

Incident Type:	Ice in Engines
ROGIDS Application:	Engine Icing
Synopsis:	A b727-200 ctr eng failed during tkof in icing conditions following deicing. Crew declared an emer and return land.
Narrative:	#2 eng failed at 400 ft agl on tkof from rwy 36r zzz. There was a noticeable thump, followed by a loss of thrust and decreasing epr. Declared an emer with twr, completed the eng fire/severe damage chklist, and landed without further incident. No fuel dump was required. The acft had been deiced in the ramp area with engs shut down, deiced again at the dep end of the rwy, and had received 2 pre-tkof contamination chks prior to tkof. Wx was rpted as 800 ft broken, 3/4 sm visibility with ice pellets and mist. Eng anti-ice was turned on immediately following eng start and remained on throughout. I do not know the extent to which the upper fuselage or eng nacelles were deiced during the deicing procs.

48 ACN: 598222

Incident Type: Ice in Engines

ROGIDS Application: Engine Icing

Synopsis: Flt crew of b737-300 need to return to deice pad to be deiced a second time after eng vibration indicators reveal presence of ice on the fan blades.

Narrative: After a long delay after pushback due to waiting for deice, we returned to gate to deice the engs after eng #2 had high vibration indication during eng run-up prior to tkof. I failed to realize that icing conditions existed as visibility was 1.5 mi and no precip was visible to us in the cockpit. I was very conscious of what happened last october and believe the damaged engs were due to ice on back of blades picked up on apch that was not removed before dep. With this in mind, i spoke with gate deice person and also went out to chk both engs to make sure ice was gone before we pushed. At the time i went outside i felt no precip but we had to be deiced at the pad due to structural ice picked up inbound. There were 8 or so planes ahead of us as we got in line. 2 other airplanes on ramp freq declined deicing and this reinforced the idea that any significant freezing drizzle/drizzle had stopped. Still not seeing any drizzle i did think about doing eng run-up anyway, but i was concerned about jetblast. Instead i snuck the eng up to 50-55% periodically as the line moved which i should have known was no help at all. We had only eng #2 running for the taxi out. We heard no other acft in line asking to clr for run-up which also made me think we were ok. After about 45-50 mins we arrived at deice pad. We started #1 eng before pulling into pad. Deice took 20-25 mins and we taxied to rwy 25. During run-up before tkof, eng #2 vibration slowly rose up to 4.0 or more so we clred rwy and called dispatch and maint ctl. The fo advocated trying another longer run-up to clr the ice. However, i was now concerned about possible eng damage shedding the ice. Although our connection with maint was not clr, i did get the idea he also preferred a return for deicing. Our return raised much concern with the deice people. I did admit we did no real eng run-ups before the rwy and did try to convince them it was my error and conditions weren't that bad. Eng #1 also had ice on spinner even though it wasn't started until we were entering deice pad. They noted no damage to either eng. After some time we were allowed to push again. This time we did 2 run-ups before deice and 1 after. I was surprised to see that only 13 mins after eng start we did see vibration rise toward 3.0 on both engs and finally drop back after 20+ seconds above 70%. During the second run-up it took 73-74% to shed ice. I also closely looked at both engs after arr and saw no damage. I'm sorry i relied too much on what i saw out the window, what i felt on my face, and my past experience, instead of what was on paper and what is expected of me. I also shouldn't have been too timid to make waves to do my job.

56 ACN: 564536

Incident Type:	Ice in Engines
ROGIDS Application:	Engine Icing
Synopsis:	B737-300 crew had suspected eng fan blade icing that was detected on the vibration monitor.
Narrative:	Wx was ifr, temp 18 degs f, visibility 1 mi. After remote deiced, took rwy 34 for tkof. Performed eng runup on rwy. Noticed initially #2 eng vibration higher than normal (3.0). After a few seconds, returned to more normal value (1.5). All other eng parameters completely normal. After runup, commenced tkof and everything was normal until 10000 ft. #2 eng went above 4.0 on vibration. I suspected eng ice and performed ice shedding proc (45% then to 80%) and ran high vibration irregular proc for eng ice. Eng immediately returned to normal value (1.5). We continued to cruise and eng was normal until dscnt. On dscnt to phl, whenever eng thrust changed (retarded or advanced), vibration would go initially to around 3.0, then return again to 1.5 or so. Now wondered if we had something more than an ice prob, as no icing conditions existed into phl. Made a log entry and discussed with maint on arr. Next day, found out eng had rotor blade warping. I believe we did everything correctly. Maybe should have retarded throttles to idle on runup and tried runup second time, but at time, did not seem necessary as eng vibration returned to normal value during runup.

55 ACN: 564691

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Application:	Engine Icing
Synopsis:	B737-300 crew had eng fan blades that had ice accumulation, and were damaged.
Narrative:	I was the capt on flt #abcd on oct/thurs/02 zzz, us. We received acft x at gate in zzz. The acft arrived with airframe ice visible due to the apch into zzz. We followed sop in having the acft de-iced. We then flew the acft uneventfully to zzz1. Upon arr in zzz1 the acft was found to have fan blade damage to the #2 eng. We were surprised to later hear about the eng damage in light of the fact that the acft was properly deiced and all acft indications were normal. Callback conversation with rptr revealed the following info: the rptr stated the airplane lndg gear, eng inlet and fan blades were deiced on the gate and after pushback was taxied to a deicing pad for the entire acft to be deiced. The rptr said after deicing a very slight vibration was noted from #2 eng and the eng was advanced to 70 percent per the flt operating manual to shed ice. The rptr stated on flt termination the r eng was found to have fan blade damage. The rptr said the airplane had been deiced per the standard ops proc.

60 ACN: 536824

Incident Type: Inadequate Deicing/Anti-icing Treatment

ROGIDS Application: End-of-Runway

Synopsis: A c150 plt goes off the end of a 2600 ft rwy on a frosty day after purporting to have removed frost from wings during preflt. Rwy condition was patchy ice.

Narrative: It was a beautiful sunny day and since i have been working on my inst rating i chose to go on a brief vfr flt to enjoy the scenery. I rented a c150 from the lcl fbo where i received my pvt plt's license from. I did a thorough preflt and found the acft to be airworthy. There was some light frost on the wings and surfaces and i brushed them down very thoroughly with a broom to remove as much as i could. I started the plane, taxied to rwy 15 and did a run-up. The twr clred me to take off and i applied full pwr and began my tkof. 1/2 way down the rwy and past vr, the plane just didn't 'feel' like it was developing enough lift and i aborted the tkof. Unfortunately, the rwy was covered in patchy ice and braking was poor. I subsequently was unable to stop in time and slid off the end of the rwy, despite having plenty of rwy to stop in under normal circumstances. My analysis of the incident has led me to a number of conclusions: 1) having always had wing covers on acft i'd flown previously, i was a little uncomfortable with the frost on the wings. I brushed it very well but it was still a concern in the back of my mind. 2) i hadn't flown a c150 in about 2 months. I had been flying c172's while working on my inst rating, so i was not totally used to flying it, but i felt comfortable enough to make the flt. 3) i chose rwy 15, which is 2600 ft long, instead of rwy 6, which is 4000 ft long, out of habit because it is closer to the fbo and the one i used most of the time in previous flts. 4) i still question whether my decision to abort was the correct choice. While the plane didn't 'feel' like it was going to lift off soon, i may not have pulled back far enough on the yoke. The frost i had brushed down so well was still a concern to me and as soon as i 'felt' like the plane wasn't going to fly, i decided to abort. Other plts who saw the plane afterwards said that i should have had no prob developing lift with how well the wings had been brushed. If i had taken the longer rwy, i wouldn't have felt the urgency to abort with the extra rwy ahead of me and might have taken off just fine. But then again, i might not have, and i didn't want to hit the end of the rwy going fast. My comfort with the acft and habit of using the rwy i chose along with my apprehension of having any kind of frost on the wing and lack of recent time in the model of plane were all contributing factors. I have certainly learned a lot from this experience. I will always take the longest rwy available from now on, and if i am apprehensive about something like the frost, i will either consult others about my concerns, or cancel the flt. I will also be more vigilant about being complacent and doing things out of habit rather than stopping and thinking them through.

3 ACN: 821285

Incident Type: Inadequate Deicing/Anti-icing Treatment

ROGIDS Applications: Post-Deicing, End-of-Runway

Synopsis: An air carrier pilot comments that after having been deiced at ZZZ, the next airport ground crew found ice on the horizontal stabilizer and other aircraft parts because they were not properly deice prior to departure. Infrequent deice operations and darkness are factors.

Narrative: Upon completion of deice in ZZZ (no anti-ice was needed due to no further precipitation falling or forecast), we received a verbal 'aircraft is clear of all contaminants' (Clean Aircraft Check) by Iceman. From our vantage point on the flight deck, that appeared to be correct. We taxied out and departed uneventfully for our destination. During our preflight in this city, we had a company jumpseater board and find a seat in the back. A few moments later, he came back onto the flight deck and told the Captain that there was a little ice on the wings just aft of the flight spoilers. We found this odd because we encountered no precipitation from the time we deiced in ZZZ all the way to our destination. We thanked him for the heads up and pushed from the gate. We taxied to the deice ramp and awaited the Iceman for another deice (again, there is no way we could have picked up any more ice). During the deice, Iceman asked us where we had departed from and we told him ZZZ. He said that the guys in ZZZ didn't do a very good job of deicing us because there was ice all over the horizontal STAB. The deice was complete with a clean Aircraft Check accomplished and we taxied out and departed uneventfully. I would like to add that I owe a great deal of gratitude to our jumpseater for bringing this to our attention. The lighting on the deicing ramp in ZZZ is very poorly lit. I think that may have contributed to the Deice Crew giving us an erroneous Clean Aircraft Check. Also, when freezing rain (Clear Ice formation) has been encountered, more vigilance should be used to make sure the aircraft is truly free of contaminants.

11 ACN: 780211

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Applications:	End-of-Runway, Post-Deicing
Synopsis:	An airbus taxiing to the runway was called back to the gate because it was not completely de-iced.
Narrative:	Requested types 1 and 4 deicing as acft had accumulated precip and snow was falling. Deice crew at remote pad gave required info at 'completion' and handed us off to pad ctl for taxi. Approx 12 mins later we were within 5 min window of flt and fo performed inspection of wing. Rpt was that wings were clr. Shortly thereafter, the twr forwarded a message to call ops. Ops advised a return to deice pad as the job was not properly completed. I shut down engs at pad and personally observed the wings as follows: l wing coated with type 4 and clean, r wing lightly contaminated with no trace of type 4. We were subsequently properly deiced, inspected, and the flt continued normally. Human factors: while the deice crew clearly omitted deicing the r wing, they had the integrity to call attn to the oversight and recall us to the pad. For this, i am grateful and sincerely hope any action taken will be moderated by their ultimate respect for safety. The nighttime view of the wing from the cabin in time of precip is difficult. I debriefed the fo and am confident he will be more observant.

14 ACN: 772707

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Application:	Post-Deicing
Synopsis:	Flt crew reports unsatisfactory deicing performance by gnd personnel as well as failure to complete required security inspection.
Narrative:	The station personnel at saw started the deicing process and i immediately noticed they were missing areas of ice on the capt's side wing. I mentioned this to the fo and told him to watch his side carefully, because i was going to have them deice us again since this was not being done correctly. The fo then asked if it was his job to pull out the tailpipe covers because they were still in during his preflt. I told him never to trust anyone and when in doubt take them out. The saw deice team finished deicing us and wanted us to start the engs. I got out of the plane, told them what a poor job they did, and it would have to be done over, also informing them that they deiced us with the tail pipe covers in and that they never noticed on their deice. After i landed in zzz i then realized that the station forgot to give us the pre-dep first flt of the day security chk, and with the chaos of the poor deicing, i totally forgot about it myself. I told my plt mgr about the deicing and the security form. The agents in saw do not care about deicing safety, or the person who trained them did not care about deicing safety enough to train them properly.

19 ACN: 764953

Incident Type: Inadequate Deicing/Anti-icing Treatment

ROGIDS Application: Post-Deicing

Synopsis: Saab 340 was improperly de-iced. The wings were only partially sprayed, and the props only received a fine mist of de-ice fluid.

Narrative: Upon taxi -ra noted with temp -2c. It was starting to freeze on impact with the acft surfaces. We requested to be de-iced. Upon reaching the de-ice pad we were instructed to go to spot x. I requested type 1 and 4 to be used. I watched the de-ice process from my window. I noticed that the de-ice truck was only spraying certain spots on the acft wing and not sweeping the wing to ensure that the entire surface would be free of the ice. I told the de-ice truck that they needed to get the entire wing. At the same time i noted that the propellers were not being fully de-iced. The de-ice truck would spray a fine mist over the prop area but not actually onto the prop blades. The de-ice crew did a visual inspection of the acft and started to apply the type 4 fluid. I told the de-ice truck that we needed the propellers to be de-iced. They stated that they do not apply type 4 to the propellers. I told them that i needed type 1 applied to the propellers and that it needed to be applied so that the entire propeller is free of ice. They stated that they would have to start the entire process again. I stated that they needed to de-ice the propellers that i could still see ice on that surface. They said that the inspection was complete. I called our dispatch to explain the delay and to request that the de-icing service supervisor could come out to the acft. My concern was that our previous aircraft that we had to do this flt was de-iced by the same crew and that they had applied type 1 directly into the ac gen intake. I did not want any further damage done to this acft but wanted the acft de-iced properly. Dispatch connected me to a manager who stated that we were up on the camera and that they could see the trucks moving around the acft but could not see anything coming from the nozzles. I told the manager that i needed this acft to be de-iced again and that they needed to apply the fluid so that it removes all of the frozen precip from the acft. The trucks did start to reapply type 1 and 4 with a more liberal application. The acft was de-iced and propellers were de-iced. We left the pad without any further incident. Inadequate training on how to de-ice a propeller in the winter. The de-ice service does not seem to understand that the propeller needs to be de-iced and that there are techniques that can be used to prevent direct contact into the engine intake. They also seem to want to spray certain spots along the wing instead of sweeping the wing to ensure properly de-iced. When they de-ice in spots there are areas left with ice. The crews (de-ice) also need to be aware of the areas on the nacelle that cannot take a direct application of de-ice fluid. This will prevent ac gen failures after the de-ice process is completed. Callback conversation with rptr revealed the following info: the reporter stated that the airline uses a contract service for the de-icing. The previous acft was improperly de-iced, and fluid was directed into the ac gen intake, disabling the gen. When de-icing the next acft, the fluid was sparsely applied to the wings, missing a considerable amount of contamination. When the props were sprayed, a fine mist was applied, and again the surfaces were not free of ice. It was only after refusing to move the acft and contacting the company that the acft was properly de-iced, spraying the entire wing surface and then directing the spray onto the props, allowing the spray to turn the props and clean the entire surface of each propeller. The reporter stated that the airline is now monitoring the procedure via camera to ensure proper de-icing. Reporter has since had an acft de-iced at the same location with no problem.

20 ACN: 764940

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Application:	Post-Deicing
Synopsis:	Crj200 flt crew discovered ice on acft after having been de-iced. Flt returned to gate for additional de-icing.
Narrative:	During pre-flight of aircraft, it was determined that due to excessive amounts of airframe ice, aircraft needed to be de-iced. After being de-iced and received de-ice report, and told that aircraft was clean, we continued with taxi whereupon we noticed ice still adhering to the windshield wipers. I decided to return to the gate to have the fo further inspect aircraft for other signs of ice and found aircraft still had large amounts of ice adhering to the tail, winglets, flaps and radome. I informed the ground crew that the aircraft needed to be de-iced again whereupon aircraft was de-iced for a second time. I instructed fo to perform another check and he reported ice still adhering to airframe. After this i spoke directly to the gentleman de-icing the aircraft who informed me that it was his first time de-icing an aircraft and asked what else he should do. I explained company's 'clean aircraft' policy and informed him that he needed to get out of truck to reach some parts of the airframe and how all ice needed to be removed in order to depart safely. After 3 attempts at de-icing the airframe it was determined that the aircraft was finally safe for flight operations. De-ice ground crew should receive better training on use of and procedures for de-icing aircraft. Supervision should be provided by the station to ensure these events do not transpire again.

25 ACN: 762902

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Application:	Post-Deicing
Synopsis:	It was necessary for a b757-200 to be deiced 3 times before an acceptable result was achieved.
Narrative:	Arrived at gate, conferred with ops and deice crew as to coord for deicing acft. Deiced at gate in light-moderate snow. Pushed back at zzz. Type 4 fluid applied. 1+45 holdover time calculated. Taxied for tkof to rwy. Taxi time approx 6 mins. Upon wing inspection fo observed 1/4-1/2 inch snow and slush adhering to leading edge as well as entire top portion of both wings. Coordinated a second deicing crew in the deicing pad. Upon arriving and looking at the wings, the deice crew was reluctant to spray the wing a second time, commenting that they felt the wing was clean and that the mixture would blow off the wing on tkof. After the second deicing the wing was still not clean, and we requested a third deicing and a close inspection of the wing by the crew. They physically felt the wing and observed that there was no ice present. Both the fo and myself now felt that the wings were clr enough and we were safe to continue. The snow had also stopped. In our opinion there was clrly something wrong with the fluid that was being applied, it did not look or behave like any type 4 we had previously been exposed to. I contacted ops on lndg and they assured me that zzz had inspected the fluid and clred it for use. This was last year's fluid.

33 ACN: 725169

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Applications:	End-of-Runway, Post-Deicing
Synopsis:	Sf350b flt crew rpts acft deiced in zzz before their dep. Upon arr in zzz1 they were notified by ops that they had departed with their tail not deiced.
Narrative:	Upon arr in zzz1 we were informed that the acft was not properly deiced in zzz. Evidently our tail was not deiced before we took off from zzz. Both the capt and i observed the gnd crew deice our respective wing then i observed the truck move around to the rear of the acft. One of the gnd crew was standing by the leading edge of my wing and i pointed to the wing and gave the thumbs up sign, this ramp agent returned the thumbs up after pointing to my wing. After 4 to 5 minutes he walked around to the front of the acft. Once he was in front of the acft, the capt gave him the sign for starting eng 2. The ramp agent responded by pointing to the #2 eng with one wand and circling the other one above his head in the approved start signal. I looked out at my wing and responded, 'clear.' we then had a normal start. After our 1 minute the capt gave the sign to start #1. The ramp agent returned the appropriate start signal to us. The capt looked out at his wing and responded, 'clear.' we had a normal start. After the capt gave him the remove chocks signal, he removed the chocks and we proceeded with the after start chklist. Upon completing that we called for taxi and taxied out for dep. On the taxi out i called ops and gave them the out time and requested the deice numbers. Ops gave me the following: deice started at 10 mins past finished at 22 mins past, type 1, -34 degs. I read them back and asked if the post chk was complete. Ops responded with 'yeah before the eng was started.' i responded with, 'thanks our off time will be 25 mins if you don't hear back from us.' this was the last time i talked to the station. We heard nothing more from the station. Nobody reached us via commercial radio while enrte. Supplemental info from acn 725170: upon getting up to zzz1 we got a message telling us that the acft tail was not deiced. The people in zzz apparently did not deice the tail yet the person in zzz gave us the sign to start.

34 ACN: 724933

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Application:	Post-Deicing
Synopsis:	Md80 capt rpts probs with deice crew, which required three attempts to get the job done properly.
Narrative:	After calling on the phone for deicing, our deicer showed up at the cockpit door and said something that neither of us understood. When i asked him to repeat himself, he asked only if we wanted him to start at the back or the front of the acft. I replied that i didn't care about that, but wanted both type i and iv applied. This was about 10 mins prior to dep xa35. At around xa55 he called on the deice freq and said that our deicing was complete, and that holdover time began at xa45. Shortly after that, another voice called us on the deice freq and said that due to an equipment prob, we would have to be completely deiced again. I made pa explaining the further delay. Shortly after that, a commuting capt called me in the cockpit on the cabin interphone. He said that it appeared to him that type iv had been applied, followed by type i. I called our deicer on the deice freq and asked if that was true, he said that the original rookie deicer had been removed from the job, and that he, a supvr, would re-do the entire process. About 15 mins later, he called on the deice freq to say that we were now properly deiced and ready to go. He did not give the new holdover time, but since the snow had by then stopped, i considered the holdover time to be currently suspended. We called ramp to get our push crew. When the crew came out, one of them got on the interphone and said that he was a certified deicer, and that our acft was not ready to go as there was snow and ice on the tail. After several calls to ramp about the prob, we were deiced for a 3rd time, again by a supvr. I don't know if it was the same supvr or not. As we discussed the whole scene later, the fo realized that he may have heard the original deicer ask if we wanted him to use type i or iv first! It appears to me that he asked us because he did not know the difference between type i and type iv. I find it appalling that acr training could certify somebody who didn't know the difference between type i and type iv. I find it frightening that a supvr, who was supposedly acting as quality assurance, could send us out to fly with snow and ice on our tail.

36 ACN: 723765

Incident Type: Inadequate Deicing/Anti-icing Treatment

ROGIDS Applications: Post-Deicing, End-of-Runway

Synopsis: An a300 was not completely deiced and arrived at its destination where ice fell from inside the cargo door. Sluggish flt characteristics were noted.

Narrative: We arrived at the arpt around xa10 pm lcl time. The present wx conditions were 9 degs and vfr. The temp had reached 20 degs that day and the sky had been clr all day. The sleet and snow had stopped sunday evening. The acft was parked at the remote ramp. I queried at the gateway about why the acft was not deiced earlier in the day. No answer was given. We were told we could not go to the acft because of the condition of the acft. I called sys ops and my dispatcher. The gateway informed me that the area around the acft was treacherous, and the acft had to be deiced. Someone from zzz1 called the gateway and the lady in ops explained the same thing to them. We were informed by the gateway that the person in charge of deicing was on the way in. This person arrived at xb00 pm, 27 mins prior to dep. We finally were taken to the acft at approx xb15 pm. The acft still had icicles hanging from the fuselage and wings. One company truck and one vendor were still deicing the acft. I was finally able to do my first walkaround at xb30 pm. 1500 gals of deicing fluid had already been applied. There was still ice all over the acft. The second deice sequence was started when i went upstairs to complete the interior preflt. The mech was working on 3 deferrals for the fuel sys. The inside was just as cold as the outside due to not being able to use the apu because of deicing. The acft sys were cold soaked and giving numerous probs since they were not warmed up. I performed a second preflt and found ice still on the acft. The mech had just finished the deferrals and i got him to walk around the acft and showed him the ice still left on the acft. He asked top because the apu was dumping smoke into the acft. No one from the gnd side conferred with the flt crew or maint prior to starting deice again and that the apu had been secured. We secured the acft and the acft was deiced in the blocks. After they finished the mech said the acft was clean. We performed a normal eng start and taxied to rwy 19r. We accomplished 2 eng run-ups with all sys ops normal. We did a max pwr tkof, and tkof was normal. During the clbout, the acft felt extremely sluggish. The acft felt like we were carrying a lot of extra wt. We notified flt ctl that we needed an ice inspection on lndg in zzz2 and to have the deice cart ready. I thought maybe we had a block of ice in the belly. The wx btwn zzz and zzz2 were vfr no clouds or precip encountered. After lndg in zzz2 i started to walk around the acft and found ice still all over the acft. I showed the mech and my coplt all the ice. The acft was covered with clr ice (extremely covered in ice). The 4th deice event took place, and an additional 400 gals and 45 mins were spent on deicing. This time the mech instructed the deice op. We departed zzz2 and the acft performed normal, and with normal responses. On arr at zzz1 i opened the cargo door and blocks of ice fell from inside the acft to the gnd. All the water drains had water pouring out at a fast rate. Maint inquired what we have been through. I explained the acft was in zzz for the winter wx. I carried the ice into the station ops. The block was thick and 5 inches wide. Obviously, the remainder was left at and on the acft. I believe the ice in zzz was masked by all the deice fluid and the deicing process was started extremely too late. The amount of ice and snow on the acft demanded more attn by the deice crews than was given. In the future, i will inspect the acft with a tactile inspection process as performed by acr, the leader in deice technology. Acr learned the hard way after the loss of numerous acft that the tactile inspection was essential to ensure flt safety. In addition, deicing after extreme conditions, as took place in zzz this weekend, call for the deice process to take place hrs before dep. This would have ensured that the fluid had drained off the acft and possibly not mask the ice. This hopefully will prevent a more serious event from taking place.

41 ACN: 640668

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Application:	Post-Deicing
Synopsis:	A b757-200 was not properly deiced and, when the holdover time was exceeded, insisted on further deice treatment
Narrative:	Cold, windy, and snowing at zzz, gnd personnel did an unsatisfactory job of deicing the acft. At gate, deicing started at xa25z and did not finish until xb15. Thus, snow started to accumulate on l wing which was first to be deiced. Told gnd crew to apply more anti/deice to l wing. They did, but not to the last 10 ft of the wing. After push, deadheading plt informed us that snow was still on last 10 ft of wing. Again, told gnd crew who told us that they had already deiced it, and that it was fine (with an attitude). Capt insisted we could not go with freezing snow on the wing. We were informed to go to the deice pad. Then we were told that both deice trucks were broken. We obtained deicing through a contractor, who did an outstanding job. However, company inability to deice us in a timely manner resulted in an unnecessary 1 hr 47 min delay!

53 ACN: 572973

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Application:	Post-Deicing
Synopsis:	B777-200 crew was not properly deiced at egll.
Narrative:	Deicing probs in lhr. The deicing equip and the training of the certified deicers is inadequate and unsafe at lhr. After a 4 hr wait on the gate a deicer finally showed up. Then after more than 30 mins of work on the acft, he had to quit, as they ran out of fluid in a truck that had just been filled. Another truck arrived within 30 mins, rpted the job to be complete with all the proper terminology and departed. As we began to push back, flt attendants notified us that pax were rpting ice on the wings. Fo confirmed we did have ice on both wings. The deicers were recalled after another delay, and they reapplied more fluid in a spray pattern from a long distance that was ineffective as observed by the fo. Again, the wings were rpted to be clr. Once again, we told the deicer it was not sufficient and pointed out to him where the ice was. The ice was finally removed on the 4th attempt. Only alert, observant pax and repeated insistence on my part prevented us from departing with an unsafe acft. In my opinion, the equip that is being used at lhr for deicing is totally inadequate for op on the b777. Callback conversation with rptr revealed the following info: snow had been falling for about 4 hrs. The temp was just at freezing. Snow had stopped when deicing had begun. The capt rpts all acr deicing at egll is handled by contract crews. They are not employees of the acr. Even thought the acr orders deicing equip appropriate to the acft, the contract deicer shows up with only 1 truck. In this case, the cherry picker deice truck was broken, so they were unable to properly deice the wings. The flc was communicating with acr ramp ctlr. He was unable to impress the contract provider that the job was not getting done. The capt rpted the incident to his chief plt, and with his support, the company is undertaking a review of the deicing contract provider.

57 ACN: 542253

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Applications:	Post-Deicing, Engine Icing
Synopsis:	B737-300 capt complaint that the gnd crew deicing personnel took 3 times to completely and adequately deice the acft prior to flt due to complacency.
Narrative:	Airplane arrived at gate in den after making apch, missed apch and subsequent apch to a lndg in rpted (actual) moderate icing conditions. Inbound capt advised the airplane should be chked thoroughly for ice. I did the walkaround and first noticed the gate deice in progress on the lndg gear and belly. Walking under the wings i noticed the entire underskin of the wing, and the flap drive fairings were coated in a rough rime approx 1/4 inch thick. The wing leading edges were clean. I also noted that the inbound crew had retracted the flaps. The tail had up to 1-2 inches of rime on the leading edges. After return to the cockpit i called the deice coordinator to determine who would deice the underside of the wings. (i advised the gate deicer had left) he said he would call the gate deicer to return to complete the job. At pushback, i asked the mech if the wings looked clean, and he said they were, but that the #1 eng fan, inlet probes and l leading edge flap were still coated with ice. I called the deice coordinator a third time to have the job completed properly. I believe the gate deicer was seriously jeopardizing flt safety with poor attn to his duty. Flt and deice crews need more info on who is responsible for deicing what parts of the airplane. I also believe the push mech helped avert a potentially serious tkof incident.

63 ACN: 503592

Incident Type: Inadequate Deicing/Anti-icing Treatment

ROGIDS Application: Post-Deicing

Synopsis: 2 acr flts have difficulty in obtaining proper deicing until after 3 attempts during inclement wx at pvd, ri.

Narrative: The flt was scheduled to depart at ab25. The inbound acft making up the flt arrived at approx ab15. Pushed from the gate at ab45. The arpt closed from ab30 until ac00 for rwy snow removal, so the capt decided to wait until it officially reopened before beginning deicing. Deicing began around ab05. After roughly 20 mins, the capt inquired about the deicer's progress, and were told that they were still using type i to deice, and the ice/snow accumulation on the wing was difficult to remove. Maint completed the type iv application at ab44. They were using only 1 truck, and upon completion of the type iv application, suggested that the maint foreman be notified because it took an excessive amount of time to deice, primarily due to only 1 truck being available. However, during subsequent deicing, they did use 2 trucks. Our taxi time to the rwy took less than 5 mins. Upon reaching the end of the rwy, the capt had the fo conduct a cabin chk of the acft for ice accumulation. The fo observed the r wing to have a smooth and glossy finish, but the l wing looked as if it had not been deiced at all. There was what appeared to be a layer of frozen precip on top of the entire wing. The fo asked the deadheading fo (a319 qualified) to take a look at the wing as well, and he concurred that it was completely contaminated. This deadheading fo, incidentally, was an a319 gnd school instructor in the mid 1990's. During later discussion with the deadheading capt, he stated that the application of the type iv fluid looked to be very modest, and not applied in accordance with the sweeping motion dictated by acr procs. We taxied back for another application of type i and type iv fluid. We were having a great deal of difficulty establishing com with the deice truck. When we finally were able to communicate, they said that they were going to get another truck, and a different mike. They got another truck, but 90% of the xmissions were still unreadable. They seemed to be able to hear us, but we could not hear them. So we directed them to continue the second deice and anti-ice application. The second application started at ad10 and was completed at ad18. After they completed this, they attempted to give a readback of the final deicing/anti-icing rpt, which was garbled. Since they were not able to communicate the deicing rpt, one of the deicers came over to the capt's side of the acft to give him a thumbs up. In the meantime, the fo (flying) was on the radio trying to get the deicing rpt relayed through ops. The deadheading fo immediately entered the cockpit, and stated that the r wing was still very contaminated. The flying fo proceeded to chk this out, and observed the same. The flying capt asked the deadheading capt to observe the wing, and he also concurred that it was badly contaminated. Again, there was less than 1 min of time btwn the time that the post application rpt was tried to be relayed/given, and the deadheading fo observed the contaminated wing. The deicing crew again gave us no indication of any contamination. The capt decided to return to the gate, and attempt to determine the cause of the contamination and rapid failure of the type iv fluid. Upon reaching the gate, the 4 plts (2 flying and 2 deadheading) proceeded outside, observed the top of the wing directly via a ladder that was placed next to the wing by a maint person and witnessed a significant slushy accumulation and complete failure of the anti-icing fluid. Less than 6 mins had elapsed from the time of the failed attempt to get a deicing rpt and this inspection. No green fluid residue was noted on either wing. While the capt of a319 flt was attempting to determine the cause of the continued contamination/failure of the deicing/anti-icing, the crew of another flt (b737-300) was being deiced. Fo communicated this sit to them. They advised that they were having maint conduct a visual inspection of the acft, subsequent to deicing. They proceeded to the rwy.

67 ACN: 494779

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Application:	Post-Deicing
Synopsis:	A b727-200 returned to the gate for a ctl chk after deicing where it was discovered the deicing was incomplete and incorrectly accomplished.
Narrative:	The night of dec/xa/00, zzz experienced freezing precip that required acft to be deiced on the morning of dec/xb/00. Snow falling that morning necessitated anti-icing after the deicing. Acft deicing and anti-icing was not done at the gate, therefore, no flt ctl chks were performed on b727 xyz during the origination preflt since there was ice obstructing the ctls. Deicing/anti-icing took place after pushback at zzz at xa39. After deicing/anti-icing had taken place and we were advised that our holdover time had started 11 mins ago, we started all 3 engs. Before we taxied from the ramp area, we began to perform a complete flt ctl chk. The r elevator indicator would not show full aft movement and it did not match the l elevator indicator. Contract maint was called. Contract maint at zzz is acr. The acr maint man came over in an acr deicing truck so he could use the lift to inspect the horiz stabilizer. After a cursory inspection of our jet, he came into the cockpit and advised us that we still had over 1/4 inch of ice on the upper and lower surface of our wings. There was anti-icing fluid, but it was covering ice. He asked us to shut down so he could inspect the tail. Our fe went out with the mech to further access the ice. He confirmed that ice was still on the acft, especially in the recessed areas around flt ctls. The mech inspected the horiz stabilizer and found ice on the stabilizer, especially in the jack screw area. We were blocking the ramp and had pax who wanted to get off, so we went back to the gate. At the gate, the acr mech thoroughly deiced the acft. He then got on the svc interphone and we did a complete flt ctl chk. The r elevator would still not indicate full movement, but the mech was able to confirm that we indeed had full movement -- the elevators matched -- and there was no damage to the horiz stabilizer or elevators. After consulting the mel, we called dispatch who conferenced in maint technician. We agreed that we had a bad elevator pos indicator and placarded the r elevator pos indicator inop in accordance with mel 27-7. This also took the acft out of cat ii which was not a factor in the dispatching of this flt.

43 ACN: 685871

Incident Type:	Inadequate Deicing/Anti-icing Treatment
ROGIDS Application:	End-of-Runway
Synopsis:	Piaggio yvanti flt crew, after an enrte stop for fuel and while refueling, encounters freezing rain. Ice forms on all surfaces. The flt crew has line svc use warm water to remove ice.
Narrative:	The flt crew wanted to depart immediately, however, the freezing rain (rpted on atis) had covered all flt surfaces with ice. The plts insisted that line svc carry buckets of warm water and pour them onto the acft. This method is unknown to me and I am filling out this rpt to cover myself from any wrong doing in case of an incident. I did express concern about this method, however, the plts insisted that it was accepted practice. After covering the forward wing, wing, and stabilizer with warm water, the acft proceeded to take off.

58 ACN: 541910

Incident Type: Inadequate Deicing/Anti-icing Treatment

ROGIDS Application: Post-Deicing, End-of-Runway

Synopsis: A dornier 328 on tkof to 110 ft had a momentary loss of elevator ctl suspected cause stabilizer snow and ice sliding back into elevator gap.

Narrative: The acft shortly thereafter was covered with snow as a squall passed over the arpt with hvy snow for approx 20 mins. The crew planned for deicing in zzz1. At approx xb41 the acft was pushed back from the gate, both engs were started and the acft was taxied to a remote deicing op. Type i deicing was applied to the entire acft, followed by type iv on the wings and tail. This process took approx 5 mins. The crew taxied the airplane onto the rwy performing a pre-contamination tkof chk (no contamination of the representative surfaces noted) and all tkof chklist items appropriate to the clrnc. Zzz1 twr clred the airplane for tkof, final chklist items were completed and the tkof roll begun. Conditions at the time of tkof were light snow, vert visibility rpted 500 ft and visibility greater than 1 mi. V-spds for the tkof reflected wet contaminated tkof data. As the acft accelerated, the pnf (the fo) made appropriate calls of 80 kts, v1, rotate. After receiving the rotate command, i (the capt) applied back pressure to the ctl column and noted that there was an opposing force. I quickly ensured the gust lock was seated in the appropriate down pos and continued to apply abnormal back pressure to the elevator. After approx 2-3 seconds, the column seemed to be relieved of all abnormal forces and the acft pitched normally. The acft was hand flown to approx 4000 ft msl while trying to note any abnormal ctl forces. The autoplt was then engaged and the acft continued to clb to a cruise alt of fl230. The crew discussed the prob noting that there was no qrc or qrh for the unexplained condition upon rotation. There were no cas messages noted on the eicas screen or flt ctl page. The crew contacted dispatch and maint ctl through zzz2 radio to discuss the current sit. It was agreed upon that the crew would perform an inflt controllability and configh chk. An emer was also declared as a precaution to a possible flt ctl failure. The flt attendant was told to prepare the cabin for a possible evac should the ctl prob reoccur. The crew put personal limitations of 5 degs nose up and down, and 10 degs bank l and r on the acft for the duration of the flt. After performing a controllability chk of all ctls (primary and secondary to include trim) and a configh chk, the crew found no abnormalities in the response of the airplane to ctl inputs. The airplane was given radar vectors to rwy 22l at zzz, where it would be met by crash and fire rescue vehicles and personnel. The acft landed uneventful and taxied to gate x where it was immediately downed for maint. The fact that the gust lock was found to be seated and no further mechanical abnormalities were experienced, leads me to believe that there was possible ice that may have inhibited movement of the elevator, but broke free as applied pressure continued to increase. Since the ctls are chked free prior to tkof, if ice was present, it must have been forward of the ctl surface and moved as airspd/airflow increased. To prevent further occurrences, if ice was the cause then de-ice procs must be especially thorough around hinge points of flt ctls.

1 ACN: 827469

Incident Type:	Fluid Failure Prior to Predicted Holdover Time
ROGIDS Application:	End of Runway
Synopsis:	Following lengthy ground delays in blowing snow the A319 flight crew returned to the gate to be de-iced a second time. Visual inspection of the wing leading edge discovered ice the length of both wings despite a time interval of less than the calculated holdover time.
Narrative:	Winter storm conditions were in effect at ZZZ that at push from the gate was moderate rain and ice pellets. During taxi, it changed over to blowing moderate wet snow, lengthy delays for deicing, temperature +2 degrees C, and a gate return was forced once taxi fuel burnout became excessive. After returning to the gate, I (the Jumpseater) stepped out onto the jet bridge to inspect the wing for ice/snow to see how well we did 1 hour after a 2 step deicing/anti-icing and still within the holdover time. I found the top of the wing clean, but the entire length of the leading edge was impacted with snow. The Captain had followed procedures for winter operations, kept alert with changing weather conditions, and was very aware of holdover times and an effectiveness of Type 4 anti-icing fluid properties. Since snowfall had tapered off somewhat, he was OK with going longer into the holdover range. Yet in spite of this, I found the leading edge was contaminated upon returning to the gate. I believe the contaminated leading edge is the result of an industry misconception about the re-accumulation of contaminants on a clean wing. Most of the wing surface is horizontal and had a Type 4 deicing fluid lying on top of it. The leading edge surfaces having been set for takeoff, sit in a near vertical position so it readily allows for gravity runoff of fluids, leaving the leading edge unprotected but still within the holdover range for a fluid which is missing from this portion of the wing. In spite of their best efforts, situational awareness, and strict adherence to company procedures for winter operations, they believe they were good to go for takeoff. A visual inspection of the wing just prior to takeoff would have easily spotted the contaminated leading edge, but not required according to procedure.

6 ACN: 819418

Incident Type:	Cabin Crew Suspected Contamination
ROGIDS Application:	End-of-Runway
Synopsis:	B737 flight crew reported a Flight Attendant concern that they departed with snow on their wings although aircraft was deiced and departed within the calculated hold over time.
Narrative:	Light snow prior to push, Deice Type-I 50/50. Anti-ice Lyondell Arctic Shield Type-IV 100%. Approximately 10 minutes prior to departure, snow intensity increased, estimated to be moderate. Holdover time 45 minutes to 1 hour 15 minutes. Departed 37 minutes after beginning of final application. All wing contamination was observed to shear prior to rotation during normal takeoff. After reaching cruises altitude, Captain went to lavatory and happened to overhear Flight Attendant Supervisor, who was on board as #4 Flight Attendant, mention her concerns relative to another airlines crash study. Captain felt it was prudent to file an ASAP for protection against any possible confusion or after the fact speculation, even though neither of us could determine any fault in our application of SOP. Supplemental information from ACN 819421: In cruse one of the Flight Attendants commented that she: 1) Thought we were returning to the gate to deice, 2) Had concerns that we departed with snow on the wings, 3) Had just come from Recurrent where they showed aircraft crashes from aircraft holding out for takeoff in snowstorms too long and attempting the takeoff. I feel that we complied with our Company procedures exactly as we have been trained and exactly as it is outlined in our manual. I do not believe we departed with ice/snow on the wings and further, the Type IV worked as expected, shearing during the takeoff roll. End of statement. I feel I should have been clearer with the Flight Attendants as to my intentions regarding when we would return to the gate should we be unable to depart. I also feel (and I communicated this to the Flight Attendant) that if she was concerned, she should have said so immediately and brought this to my attention. In discussion with all the Flight Attendants, I told them to always bring their concerns to the attention of the cockpit Crew as their input is valid and essential.