

Remote On-Ground Ice Detection Systems (ROGIDS)

Update

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Federal Aviation
Administration



Ground Ice Detection Systems (GIDS) History

- **FAA's Flight Safety Research Branch sponsored the initial GIDS research in the mid-1990's.**
- **A technology demonstrator was produced under contract by RVSI.**
- **Competing prototype commercial systems were developed by RVSI and SPAR Aerospace in the late 1990's.**
- **RVSI GIDS technology was purchased by Goodrich Aerospace.**
- **SPAR Aerospace purchased by MDA.**



GIDS History

- **The original GIDS Minimum Operational Performance Specification (GMOPS) ED104 was developed under the auspices of EUROCAE.**
- **ED104 was adopted by SAE as AS5116b.**
- **A sticking point for some: The minimum detection threshold**
 - AS5116b/ED104 specified a 0.5mm/0.020inch minimum detection threshold.

GIDS History

- **Others felt the naysayers were ignoring the reality that airplanes were taking off with residual ice (hiding behind the “Clean Aircraft Concept”).**
- **The discussion turned into an endless argument.**



GIDS History

- The issue came to a head at the raucous “GIDS, Where do we go from here?” session at the 2003 Chicago Conference.
- Out of that session came an agreement to form an FAA / Transport Canada (TC) / Industry GIDS Regulatory Approval Working Group (GIDS RAWG), working under the SAE G-12 Ice Detection Subcommittee.



GIDS History

- **The first meeting of the GIDS RAWG was held March 2004.**
 - The threshold issue continued to be the major stumbling block.
- **I made the suggestion that the issue be looked at from the perspective of whether the GIDS did an as good as or better job of detecting residual ice than deicing personnel.**
 - Could GIDs provide an equivalent or better level of safety?



GIDS History

- **The FAA Flight Safety Branch and the TC Transportation Development Center decide to move forward and collaborate on a GIDS vs Deicers research project.**
- **As the first GIDS application will be for post-deicing inspections, the research was focused in this area.**
- **Early on, we realized we needed help from human factors experts.**



GIDS History

- **The WG brought FAA Technical Center human factors experts on-board during the early planning stages.**
- **The WG decided to allow them to design, develop, and perform the tests as an independent, impartial entity.**
- **The HF experts determined that two series of tests were necessary:**
 - Visual and tactile ice detection threshold study.
 - GIDS vs deicers comparison study.

Threshold Study Setup

Visual:

- 315cm² clear ice patches of 0.2, 0.35, 0.5, 0.65, and 0.8mm thickness were placed on white painted aluminum plates.
- Ice sheets of 0.5 and 1.0mm thickness completely covered bare aluminum plates.

Tactile:

- Ice sheets of 0.2 and 1.2mm thickness completely covered white painted aluminum plates.
- The tests were conducted with gloves on.

All plates were covered with diluted Type I deicing fluid to simulate the post deicing environment.

Threshold Study Setup

- **Participant demographics**
 - 6, male, professional deicers
 - AeroMag 2000, Montreal, Canada
 - Ages 21– 47
 - 3 Ranges of Experience (Average 8.8 years)
 - Inexperienced (2 years or less)
 - 6 months
 - 7 months
 - Mid-experience (3 years- 8 years)
 - 8 years
 - 7 years 8 months
 - Experienced (10 years and above)
 - 20 years
 - 16 years



Threshold Study Visual Test Setup



Threshold Study Tactile Test Setup



Threshold Study Results:

- **315cm² clear ice patches of 0.8mm thickness or less are almost impossible to see on painted surfaces.**
- **Ice sheets of 1.0mm thickness or less were difficult to impossible to see on both bare aluminum and white painted surfaces.**
- **Ice patches and sheets were easily detected tactilely, even with rubber gloves on.**

Comparison Study Setup

Ice patches (8 and 16 inch diameter, 0.3-0.5 and 0.6-0.8mm thickness) under deicing fluid on a JetStar wing.

Test Scenarios:

- 1. High contamination (12 ice patches).**
- 2. Low contamination (3 ice patches).**
- 3. No Contamination.**

Comparison Study Setup

Test Participants:

- 9, male, professional deicers
- 3 AeroMag 2000, Montreal, Canada
- 6 Servisair, Toronto, Canada
- Ranges of Experience
 - 3 Inexperienced (2 years or less)
 - All 1 - 2 years experience
 - 4 Mid-experience (3 years- 8 years)
 - All 7- 8 years
 - 1 Experienced (10 years and above)
 - 24 years
 - 1 Unknown

Comparison Study Setup

Two Prototype ROGIDS Used:

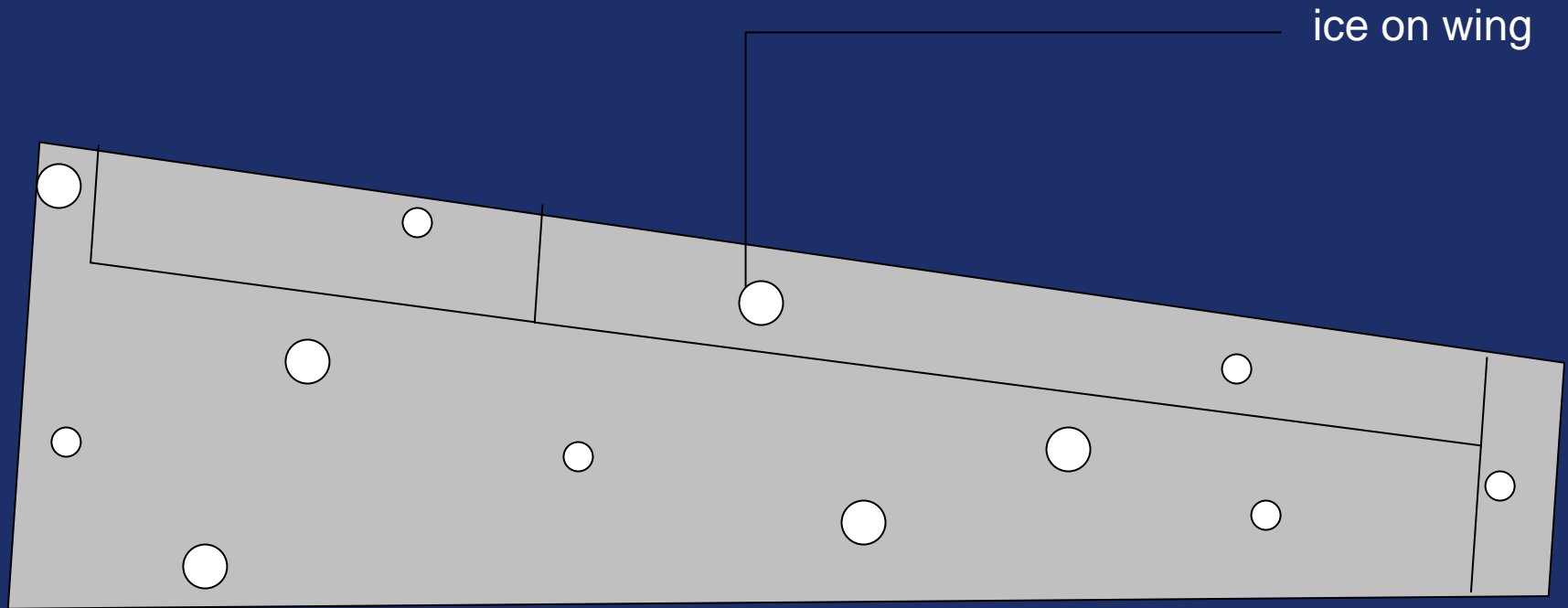
- **MDA**
- **Goodrich**

Visual, tactile and GIDS inspections performed for each scenario.

Comparison Study JetStar Wing



Ice Sample Distribution



* Locations of ice randomly assigned

Comparison Study Results

- **GIDS 1 better than deicers.**
- **GIDS 2 essentially equivalent to deicers.**
- **GIDS 1 when operated by manufacturer personnel got perfect scores, implying that experience is a factor in the proper interpretation of the display.**
- **Even though ice was easily detectable tactilely during the threshold study, the deicers still missed ice patches on the wing during their tactile inspections!**

The Results

- The results of the 2 studies were presented at the G-12 Ice Detection Subcommittee meeting in Lisbon May 2006.
- The Ice Detection Subcommittee decides to establish a GMOPS working group to revise AS5116 using the information gained from the human factors studies.



ROGIDS GMOPS

- Early on, the WG realized that AS5116c/ED104 tried (unsuccessfully) to be all things to all GIDS (ground based, on-board, on-board remote).
- The WG decided to concentrate on Remote On-Ground Ice Detection Systems for use during pre and post-deicing inspections.
- AS5116c/ED104 to be cancelled and replaced by AS5681.
- GMOPS for other types/applications of GIDS to be developed as needed.



ROGIDS Current Status

- **AS5681 approved by ID Subcommittee July 30 2007. Approved by SAE Aerospace Council September/October (?) 2007.**
- **Next step: FAA and TC Flight Standards organizations to coordinate development of Advisory Circulars to provide ROGIDS manufacturers the test parameters called for in AS5681, and guidance to FAA POI's in approving the use of ROGIDS.**



ROGIDS Current Status

- **With the publishing of AS5681 and the Advisory Circulars, ROGIDS manufacturers will have the path to regulatory approval they have demanded before further investment in commercializing their products.**





To Download The Test Reports:

- http://www.tc.faa.gov/acb300/Techreports/T_C06_21_GIDS_new.pdf
- http://www.tc.faa.gov/acb300/Techreports/T_C06_20_GIDS.pdf
- **For a copy of the paper regarding the Threshold Study Pre-tests:** Sierra, E. A., Jr., Bender, K., Hadley, J., Marcil, I., D'Avirro, J., Moc, N., Pugacz, E., & Eyre, F. (2005). Preliminary test of human visual and tactile ice detection capabilities under post-deicing conditions. Paper presented at a meeting of the Human Factors and Ergonomics Society, South Jersey Chapter, Atlantic City Airport, NJ.

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