

3rd Ice Prediction Workshop: Closing Discussion and Way Forward

Andy Broeren, Éric Laurendeau

NASA Glenn Research Center; Polytechnique Montréal — on behalf of the IPW3 Organizing Committee

Presented 24 September 2026

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3rd Ice Prediction Workshop

Closing Discussion and Way Forward

Sponsored by the AIAA Atmospheric and Space Environments Technical Committee

AIAA IPW-3

On-line Only

21-24 September 2026

Outline

- Workshop Agenda
- IPW-3 Summary
- IPW-3 Conclusions
- Way Forward and Next Steps

Agenda—Monday and Tuesday

DAY 1 Monday, September 21, 2026	
START – END	SESSION
9:00 – 9:30 AM	Ice Prediction Workshop – Welcome, Background, and Motivation Andy Broeren – NASA Glenn; Éric Laurendeau – Polytechnique Montréal
9:30 – 10:15 AM	TFG-1 Overview and Outcomes Alberto Pueyo – Bombardier
10:15 – 11:00 AM	Ice Shape Comparison Study and Survey Alessandro Donizetti – Politecnico Milano; Ariane Vieira – AeroTex GmbH;
11:00 – 11:30 AM	BREAK
11:30 AM – 12:00 PM	TFG-2 Test Case Descriptions and Motivation Thomas Ozoroski – NASA Glenn
12:00 – 12:45 PM	Code-to-Code Comparisons — Case 1: 21-inch NACA 0012 Karim Zayni – Polytechnique Montréal
12:45 – 1:00 PM	<ul style="list-style-type: none"> • End of Day Discussions and Wrap-Up Andy Broeren – NASA Glenn; Éric Laurendeau – Polytechnique Montréal

DAY 2

Tuesday, September 22, 2026

START – END	SESSION	
9:00 – 10:00 AM	Code-to-Code Comparisons — Case 2: In-Flight ONERA M6 Karim Zayni – Polytechnique Montréal	
10:00 – 10:30 AM	TFG-1 Ice Shape Comparison Metric Analysis Applied to TFG-2 Ariane Vieira – AeroTex GmbH; Alessandro Donizetti – Politecnico Milano	
10:30 – 11:00 AM	Analysis and Discussion of TFG-2 V&V Exercise Thomas Ozoroski – NASA	
11:00 – 11:30 AM	BREAK	
PRESENTER SESSION 1 SESSION CHAIR: IFRAH MUSSA – KINGSTON UNIVERSITY		
START – END	ORGANIZATION & PRESENTER	SOFTWARE
11:30 – 11:55 AM	National Institute for Aviation Research Harsh Shah	FENSAP-ICE
11:55 AM – 12:20 PM	Collins Aerospace Mateusz Pawlucky	FENSAP-ICE
12:20 – 1:00 PM	<ul style="list-style-type: none"> • End of Day Discussions and Wrap-Up Andy Broeren – NASA Glenn; Éric Laurendeau – Polytechnique Montréal	

Agenda—Wednesday and Thursday

DAY 3 Wednesday, September 23, 2026		
START – END	ORGANIZATION & PRESENTER	SOFTWARE
PRESENTER SESSION 2 SESSION CHAIR: JULIEN CLIQUET – AIRBUS		
9:00 – 9:25 AM	Synopsys Isik Ozcer	Fluent Icing
9:25 – 9:50 AM	The Boeing Company Soroush Yazdani	GlennICE
9:50 – 10:15 AM	NASA Glenn Research Center Thomas Ozoroski	GlennICE
10:15 – 10:40 AM	Airbus Commercial Aircraft Alberto Della Noce	IGLOO3D
10:40 – 11:05 AM	BREAK	
PRESENTER SESSION 3 SESSION CHAIR: MARIACHIARA GALLIA – TU BRAUNSCHWEIG		
11:05 – 11:30 AM	ONERA Emmanuel Radenac	IGLOO3D
11:30 – 11:55 AM	Sikorsky, A Lockheed Martin Company Kim Jeewoong	STAR-CCM+
11:55 – 12:20 AM	École Polytechnique Montréal Karim Zayni	CHAMPS
12:20 – 1:00 PM	<ul style="list-style-type: none">• End of Day Discussions and Wrap-Up Andy Broeren – NASA Glenn; Éric Laurendeau – Polytechnique Montréal	

DAY 4 Thursday, September 24, 2026		
START – END	ORGANIZATION & PRESENTER	SOFTWARE
PRESENTER SESSION 4 SESSION CHAIR: EMMANUEL RADENAC – ONERA		
9:00 – 9:25 AM	Bombardier Guy Fortin	DRAGONICE
9:25 – 9:50 AM	CIRA Francesco Capizzano	SIMBA-ICE
9:50 – 10:15 AM	AeroTex GmbH Ariane Vieira	IHB3D
10:15 – 11:00 AM	<ul style="list-style-type: none"> • End of Workshop Wrap-up and Discussion Andy Broeren – NASA Glenn; Éric Laurendeau – Polytechnique Montréal 	
11:00 – 11:30 AM	BREAK	
11:30 – 12:15 PM	<ul style="list-style-type: none"> • Post IPW3 Way Forward Andy Broeren – NASA Glenn; Éric Laurendeau – Polytechnique Montréal 	

IPW-3 Summary

- Two Technical Focus Groups
 - TFG-1 3D Ice Shape Comparison
 - TFG-2 Verification and Validation
- TFG-2 featured NACA0012 test cases with experimental data and ONERA M6 test cases code-to-code
 - Included: four grid refinement levels; four drop-size distributions
- Outstanding participation
 - 64 registered attendees from 12 countries
 - 20 total presentations from academia, research centers and commercial companies
 - 12 individual participant presentations for TFG-2 and 14 participants submitted data for TFG-2
- Great interaction between TFG-1 data comparison metrics and TFG-2 results.
- Plan to have dedicated technical sessions at SAE Icing Conference to further document results.

IPW-3 Conclusions

- TFG-1 supported the continued development of two new metrics to assess geometric comparison of ice shapes.
 - Going forward, we need good names for the metrics to be further introduced to the community.
- The application of these new metrics to TFG-2 data is a first-of-its kind activity. We have new tools and are beginning to understand how they may be used.
 - The workshop provided a current assessment and ideas for further updates to these metrics.
- TFG-2 has successfully demonstrated the ability to obtain numerically converged results for airflow, drop impingement and water mass for the two test cases.
 - This has led to a deeper dive into code differences related to turbulence model implementations; heat transfer coefficient calculations; surface water transport; and ice-growth approaches.
 - Ice density modeling also remains a challenge—there are a variety of approaches with no standard.

IPW-3 Way Forward

Short Term – Until June 2027

- Organizing committee meeting on October 6
- Continue to work on TFG-1 and TFG-2 activities and document in papers for SAE Icing Conference.
- Identify best practices and lessons learned that could be included in SAE ARP5903.

SAE International Icing Conference

- Perhaps have a panel discussion / organizational meeting for IPW-4

IPW-3 Way Forward

Longer Term – After June 2027

- We throttled down from IPW2 to IPW3, and can now confidently throttle up on more complex cases with flow separation and SLD effects
- Provide additional important parameters, such as turbulence intensity, Roughness closure model, heat flux calculation method.
- Uncertainty quantification with ice accretion algorithms.
- Determine best practice for roughness at initial step to capture proper water impingement.
- More experimental results with repeat runs; attempt to look at mass differences between AE3932 and AE3933.

IPW-3 Way Forward

Longer Term – After June 2027 Continued

- Aerodynamic analysis to relate aerodynamic sensitivities to ice geometry.
- Stagnation point position on 2D ice shapes, deep-dive
- water shedding deep-dive
- Freezing fraction definition formalization
 - With or without evaporation
 - Two separate freezing fractions?
- Multishot: initiation shot length effect on final ice shape (initial run on smooth air)
- Data collection
 - Grid IDs in tecplot zone names
 - Wrap distance, ice thickness, ice accretion, evaporation as additional cut data fields

Thank You