



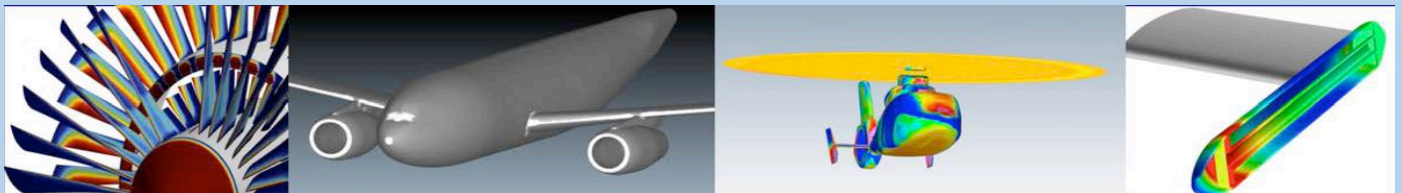
## 19<sup>th</sup> INTERNATIONAL ICING COURSE

Simulation Methods for the In-flight Icing Certification  
of Aircraft, Rotorcraft and Jet Engines

a 4-day **online** course, Tuesday October 12 - Friday October 15, 2021

By instructors who have teamed up on engineering projects,  
have certified aircraft and have published scientifically together!

**Prof. Wagdi HABASHI, Director CFD Lab-McGill University and President CERTIF-ICE Inc.**  
**Dr. Alberto PUEYO, Icing Lead, Bombardier Aviation**  
with the participation of ANSYS-Canada



The 18<sup>th</sup> International Icing Course scheduled for May 2020 was canceled, as were so many similar events, due to the pandemic that has not receded much since.

Due to several requests, the 19<sup>th</sup> International icing Course will be held in 2021 online. It will have the same instructors but a condensed content and a style specially adapted to an online delivery (see \*).

It is a timely opportunity to attend this unique annual course  
in the comfort of your office, with no visas, no travel and no associated expenses.

# Come and See the Best Simulation Tools for Certification

For an aircraft, rotorcraft or jet engine to obtain a type design certification, it must be demonstrated that it can sustain safe flight into known or inadvertent icing conditions. The icing certification process involves CFD (Computational Fluid Dynamics) analyses, wind and icing tunnel testing (EFD: Experimental Fluid Dynamics), all considered “simulation”, and final demonstration of compliance through Flight Testing in Natural Icing (FFD: Flight Fluid Dynamics).

Modern 3D CFD-Icing methods such as FENSAP-ICE, working as a direct extension of CFD-Aero technologies, have become an indispensable, if not a primary tool, in the certification process. They are rapidly replacing 2D and 2.5D methods (**airfoils don't fly; aircraft do**). They enable analyzing the aircraft (fuselage, wing, engines, nacelles, cockpit windows, sensors, probes, etc.) as a system and not as an assemblage of isolated components. The judicial integration of CFD-EFD simulation tools provides a cost-effective aid-to-design-and-to-certification, when made part of a well-structured compliance plan. CbA (Certification-by-Analysis) being a current “hot” subject; this course puts it into real practice, providing efficient tools and showing examples of capabilities and limitations.

The course will show how modern 3D icing codes are based on highly validated physical models (Scientific VVV) as opposed to a Catch-22 calibration of codes against icing tunnels to yield heuristic models. The course will also show how Reduced Order Models can make fully-3D calculations inexpensive (yielding **3D CFD with 10-20 million points + impingement + icing + performance in 1/100<sup>th</sup> of a second**, after the calculation of an appropriate number of “snapshots”: this is even faster than 2D panel methods calibrated codes!) and enable rapid identification of aerodynamic and thermodynamic critical points in a structured way and not a heuristic one. By inclusion of icing requirements at the aerodynamic design stage, a more comprehensive exploration of the combined aerodynamics/icing envelopes, optimized IPS design, and focused/reduced wind tunnels, icing tunnels and flight tests. The end result is a faster design, faster testing, faster natural icing campaign, and a safer aircraft that is easier to certify.

This course is structured to be of equal interest to aerodynamicists, icing, environmental systems and flight simulation engineers, regulators and Designated Engineering Representatives. Detailed knowledge of CFD is not necessary.

The lectures cover the major aspects of in-flight icing simulation, ice protection systems, handling quality issues. The instructors bring an amalgam of knowledge, as scientists who have produced codes in current use and engineers with certification experience, along with cost-effective simulation methods widely used internationally for certification of aircraft for flight into known icing.

## “Online” Course Details

- The course will be given online, using ZOOM, from Tuesday October 12 to Friday October 15, 2021
- The course will start at 10 am EDT and end at 3 pm EDT (followed by an optional interactive Q&A session) : this schedule is “manageable” for attendees from the Americas (East and West Coast) and Europe\*
- All lectures are 75-minute long
- The minimum number of registrants for the course will be 10 and the maximum 20: final decision to hold the course will be made by September 6
- To promote interaction and to prevent the proliferation of the course content:
  - Attendees will be required to leave their video feed on
  - Videotaping will not be allowed, and
  - Course notes will be made available to attendees on a dedicated website to consult during and after the course, with no downloading
- The cost of this condensed course has been appropriately reduced

\* Should a sufficient number of attendees register from time zones with more than 8 hours difference, such as Asia, consideration will be given to splitting the lectures over 2 weeks of 3 half-days each. This would only be decided by September 6.

# Join a Prestigious Community of Participants

83 organizations from 20 countries

## Attended by more than 83 organizations from 20 countries

Agency for Defense Development (Korea)  
Agusta Westland (Italy)  
ANSYS, Inc. (USA, Canada, Germany, Turkey)  
Airbus (France, Germany, Spain, U.K.)  
Austrian Institute of Technology (Austria)  
Aviadvigatel OJSC (Russia)  
Aviation Partners (USA)  
AVIC Commercial Engine Company (China)  
Barcelona Supercomputing Center (Spain)  
Battelle Memorial Institute (USA)  
Bell (USA, Canada)  
Beihang University (China)  
Beijing Vision Strategy Technology Ltd. (China)  
Boeing (USA)  
Bombardier Aerospace (Canada)  
CAE Inc. (Canada)  
Central Institute of Aviation Motors (Russia)  
China Helicopter (China)  
COMAC Flight Test Center (China)  
Commercial Aircraft Company of China - COMAC (China)  
Daher Socata (France)  
Dassault Aviation (France)  
DLR (Germany)  
Dornier Seawings (Germany)  
DRD Technology (USA)  
Dowty Propellers (U.K.)  
EDR & Medeso (Sweden)  
EADS (Germany)  
Eurocopter (France)  
Evektor (Czech Republic)  
First Aircraft Institute - AVIC (China)  
General Atomics Aeronautical Systems (USA)  
General Atomics (USA)  
General Electric (USA)  
Goodrich (USA)  
Gyeongsang National University (Korea)  
Hamilton Sundstrand - UTC (USA)  
Harbin Aircraft Industry Group - AVIC (China)  
Honda Aircraft Engine R&D Center (Japan)  
Hurel-Hispano (France)  
Industria de Turbo Propulsores - ITP (Spain)  
Instituto Nacional de Técnica Aeroespacial (Spain)  
Korean Aerospace Industries (Korea)  
Aerospace Research Institute (Korea)  
Korean Air (Korea)  
McGill University (Canada)  
Liebherr (France)  
Lockheed Martin Aerospace Corp. (USA)  
Luleå University of Technology (Sweden)  
Meteo France (France)  
Mitsubishi Heavy Industries (Japan)  
Military Technical College (Egypt)  
Ministry of Defence U.K. (U.K.)  
Nanjing U. of Aeronautics & Astronautics (China)  
Narvik University College (Norway)  
National Transportation Safety Board (USA)  
Northrop Grumman (USA)  
ONERA (France)  
Pall Aerospace (U.K.)  
Pilatus (Switzerland)  
Pratt & Whitney (Canada)  
QinetiQ (U.K.)  
Rolls-Royce (U.K.)  
Russian Helicopters (Russia)  
SAAB Aerosystems (Sweden)  
Sabena Technics (France)  
Shanghai Aircraft Design & Research Institute (China)  
Shenyang Aero Engine Research Institute (China)  
SNECMA Moteurs (France)  
SONACA (Belgium)  
Transitiels Technologies (France)  
TUPOLEV (Russia)  
Turkish Aerospace Industries (Turkey)  
ULTRA Electronics (U.K.)  
Università di Trento (Italy)  
UTC Aerospace Systems (USA)  
Vattenfall (Norway)  
Vestas Tech R&D (Denmark)

## Attended by the major certification agencies

Civil Aviation Administration of China - CAAC (China)  
European Aerospace Safety Association - EASA (European Union)  
Federal Aviation Administration - FAA (USA)  
Interstate Aviation Committee - MAK (Russia)  
Korea Certification Agency - (South Korea)  
Swiss Federal Office of Civil Aviation - (Switzerland)  
Transport Canada Civil Aviation - TCCA (Canada)

## Course held for 19 years in 8 countries, over 3 continents

Battelle Memorial Institute (online), 2020  
McGill University, Montreal, Canada, 2020 (canceled, pandemic)  
McGill University, Montreal, Canada, 2016-2019  
Barcelona Supercomputer Center, Barcelona, Spain, 2014  
Fort Worth, Texas, USA, 2013  
École Centrale de Lyon, Lyon, France, 2012  
COMAC-SADRI-CAAC, Shanghai, China, 2011  
Gyeongsang National University, Jinju, South Korea, 2010  
University of Nevada Las Vegas, Las Vegas, USA, 2009  
Universidad de Sevilla, Sevilla, Spain, 2007  
Barcelona Supercomputer Center, Barcelona, Spain, 2006  
European Aviation Safety Agency, Köln, Germany, 2005, 2015  
McGill University, Montreal, Canada, 2004  
The University of Cambridge, Cambridge, U.K., 2003  
Florida International University, Miami, USA, 2002  
Universitat Politècnica de Catalunya, Barcelona, Spain, 2002

# Course Agenda \*

TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
<i>Lecture 1</i> Fundamentals of In-flight Icing (Prof. Wagdi G. HABASHI)	<i>Lecture 5</i> CFD for SLD and Ice Crystals (Mr. Cristhian ALIAGA)	<i>Lecture 9</i> CFD for Jet Engines (Dr. Isik Ozcer)	<i>Lecture 13</i> CFD for Helicopters (Prof. Wagdi G. HABASHI)
<i>Lecture 2</i> CFD for In-flight Icing (Prof. Wagdi G. HABASHI)	<i>Lecture 6</i> Hybrid Simulation: CFD + EFD (Dr. Alberto PUEYO)	<i>Lecture 10</i> An Intro to Certification Rules (Dr. Alberto PUEYO)	<i>Lecture 14</i> CFD-icing Scientific VVV (Prof. Wagdi G. HABASHI)
<i>Lecture 3</i> Ice Protection Systems (Dr. Alberto PUEYO)	<i>Lecture 7</i> Operating in Known-icing: Aerodynamic Impact , 1 (Dr. Alberto PUEYO)	<i>Lecture 11</i> Simulation Methods Used in the Certification of Aircraft, 1 (Dr. Alberto PUEYO)	<i>Lecture 15</i> Reduced Order Modelling: The Road to Certification by Analysis (Prof. Wagdi G. HABASHI)
<i>Lecture 4</i> CFD for Anti-icing & De-icing (Mr. Cristhian ALIAGA)	<i>Lecture 8</i> Operating in Known-icing: Aerodynamic Impact , 2 (Dr. Alberto PUEYO)	<i>Lecture 12</i> Simulation Methods Used in the Certification of Aircraft, 2 (Dr. Alberto PUEYO)	Interactive Q&A Period
Interactive Q&A Period	Interactive Q&A Period	Interactive Q&A Period	

\* Suitable adjustments to the schedule/contents may be made depending on the cross-section of participants.

## Comments from Participants:

".....Presentations are excellent!"

".....Thank you for a great course!"

".....Excellent speakers!"

".....The speakers were knowledgeable."

".....Material is clear and comprehensive."

".....Amazing to see the validated 3D certification tools, when some people are still using 2D."

".....Cost reasonable with respect to other courses."

".....Response regarding registration and logistics was prompt!"

# **"Electronically Fillable" Registration Form**

## **19<sup>th</sup> International Icing Online Course, October 12-15, 2021**

Title:  Prof.  Dr.  Mr.  Mrs.                      Date: \_\_\_\_\_

First Name: \_\_\_\_\_ Family Name: \_\_\_\_\_

Organization / Company: \_\_\_\_\_

Division / Dept: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

\_\_\_\_\_

City: \_\_\_\_\_ ZIP / Postal Code: \_\_\_\_\_

State / Province: \_\_\_\_\_ Country: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

E-mail: \_\_\_\_\_

Signature: \_\_\_\_\_

### **Registration Fee:**

1 person	\$1000 USD
2 persons from the same organization	\$800 USD each
3+ persons from the same organization	\$700 USD each
Airworthiness authorities personnel	\$700 USD each
Students	\$500 USD each

**Payment: By credit card**, <https://19th-international-icing-course.eventbrite.ca>

**Payment: By bank transfer**, National Bank of Canada, 500, Place D'Armes, Montreal, QC Canada H2Y 2W3  
Swift Number: BNDCCAMMINT - Account: 000614601-00804-65

**Payment: By USD check**, mail to CERTIF-ICE.

### **For registration, please mail this form to:**

CERTIF-ICE Inc.

2385 Chemin du Bord-du-Lac-Lakeshore

Dorval, QC Canada H9S 2G7

Please note that completing the registration form is only a placeholder: registration is complete only when full payment is received. Registration fees are due at the latest 4 weeks before course starts. Cancellations are at a 5% service fee, up to 4 weeks before the course date. No cancellations accepted after that date. For any additional information, please contact [jenny@certifice.com](mailto:jenny@certifice.com)