ROTORCRAFT ICING OPERATIONS AND ICE PROTECTION SYSTEM DEVELOPMENT

TRACK OUT-BRIEF REPORT

20 JUNE 2003

FAA Inflight Icing/Ground Deicing International Conference & Exhibition
Chicago, Illinois 16-20 June 2003

Rotorcraft Icing Papers

There were 11 papers presented in the Rotorcraft track:

- Four on design for icing conditions
- Four on operations and testing in icing
- Three on icing codes for rotorcraft

This was followed by a panel session that discussed rotorcraft icing needs and issues

Rotorcraft Icing Certification/qualification Status

EUROCOPTER SUPER PUMA (120 AIRCRAFT WITH RIPS)

DGAC CERT 1983, FAA CERT 1984

SIKORSKY BLACK HAWK/SEAHAWK (2450 AIRCRAFT WITH RIPS)

US ARMY QUAL 1982, US NAVY QUAL 1985

WESTLAND AGUSTA EH101

LIMITED UK MoD QUAL, FULL QUAL AND CIVIL CERT ON HOLD

EUROCOPTER NH90, EC225 (SUPER PUMA MK2+), EC155

QUAL/CERT PROCESSES INITIATED

SIKORSKY S-92A

ICING CERTIFICATION PROCESS INITIATED

BELL AGUSTA BA609

ICING CERTIFICATION PROCESS INITIATED

Presentation Questions/answers

- Ice shedding models are empirically based.
- EH101 certification effort has been placed on hold for market /financial reasons. The aircraft has a warm icing temperature MoD qualification.
- An operator has helicopter experience in warm temperature SLD (freezing drizzle) conditions, but the Rotorcraft Flight Manual was revised to prohibit such operations.
- Ice has not been observed aft of blade heaters, even in SLD (freezing drizzle).
- Higher torque rises and higher vibrations have been observed in very cold icing conditions on one helicopter model.
- Eurocopter tests shown that carbon/graphite blade heaters had greater fatigue resistance than metalic heaters.
- Eurocopter and Sikorsky have tested empennage simulated ice shapes, but they have not yet tested rotor blade simulated ice shapes.
- The NH90 has been tested in natural icing conditions down to -15 deg C in France and Germany.
- Concern for blade-mounted ice detector reliability resulted in a design that incorporates multiple sensors. The system must be designed to avoid false negatives in icing conditions.

Questions Asked In Panel Meeting

Why are EH101 and other rotorcraft not certificated for flight in icing now? Cost? Time to test?

How does a company acquire enough data to validate codes and validate the use of tankers, tunnels, and simulated ice? What is truth for helicopter icing?

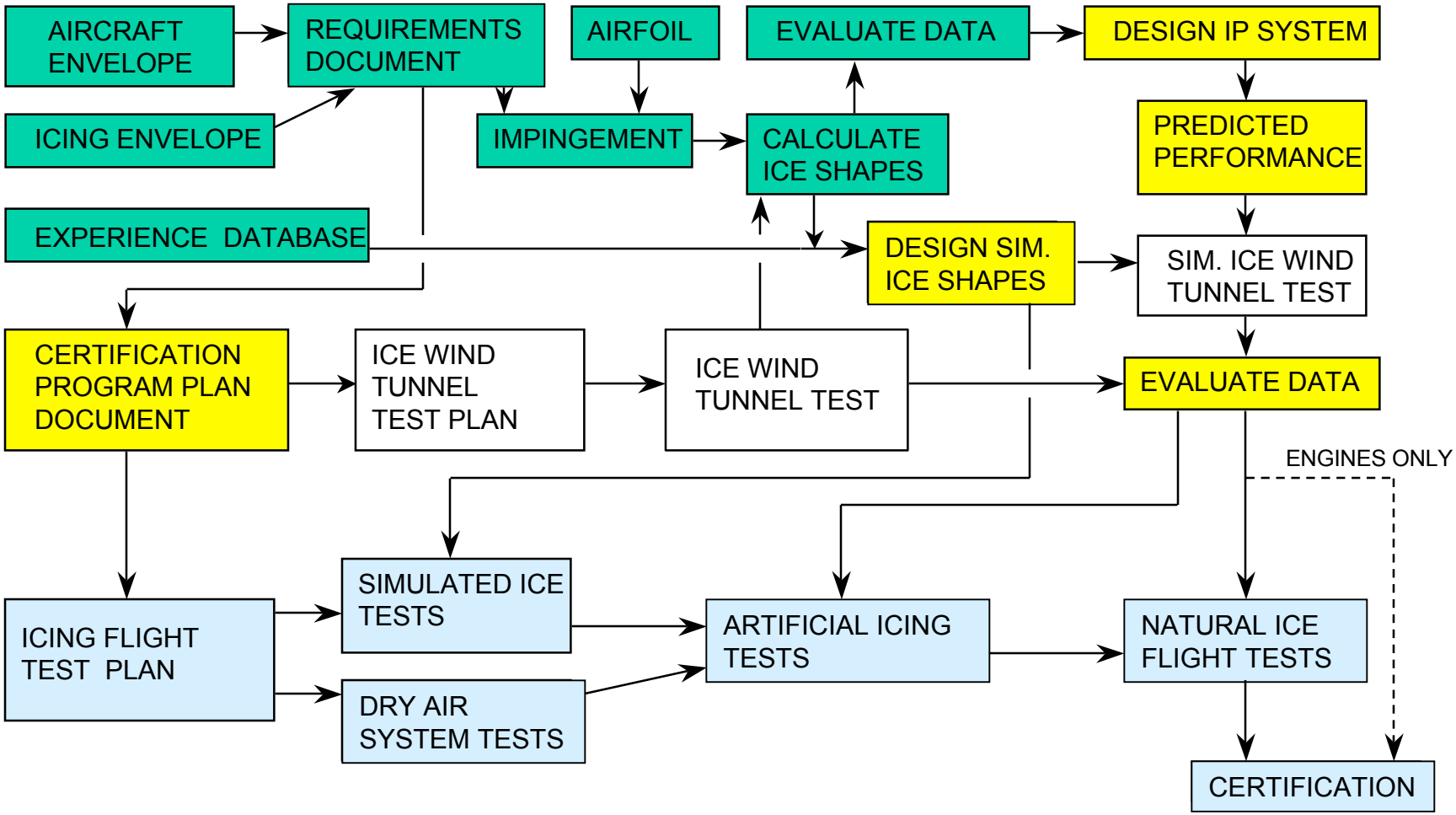
What are code, simulated ice, and artificial icing validation criteria?

How much/what part of the Appendix C data must be found to validate rips operation? When does an applicant have enough natural icing data to merit certification?

What is necessary to have the regulatory authorities be proactive rather than reactive?

Can the industry produce a common certification approach and get regulatory acceptance for that approach?

Can we define a helicopter icing certification process that is common across the industry?



What is the role of the McKinley Climatic Laboratory for rotorcraft certification?

ROTORCRAFT ISSUES AND NEEDS

Need mature standards for ice protection system certification.

Need a successful helicopter certification program to build upon.

Need an investment strategy for R&D that is supported by the rotorcraft industry and need a partnership between method developers and method users.

Time and cost to certificate a helicopter may not match market needs.

Weight of ice may have an adverse impact on aircraft CG.

Need to be able to recognize, tolerate and/or avoid SLD conditions.

Need to validate alternate certification methods.

Need to determine validation criteria for alternative methods.

Need to reduce regulatory authority's concerns over use of alternative certification methods and build confidence in these methods.

Need to get natural icing flight test data that is steady enough to be a standard, to be the "truth" for methods validation.

Need additional guidance document beyond AC 29-2C.1419 and AC 20-73A that contains internationally accepted practices for rotorcraft certification.

What really matters? What is good enough? What produces a conservative result?

SAE AC-9C Action Topic - April 2003
Helicopter Issues

While AC-9C recently published a revision to the helicopter electrothermal ice protection AIR (AIR1667A), AC-9C decided that there is a need to assess other rotorcraft icing issues.

Questions listed during the Dayton meeting to be discussed by a panel prior to the fall AC-9C meeting include the following:

- What happens to drops that pass through a rotor and strike aft blades and what are the resulting ice shapes?
- What is validity of rotor tests in tunnels?
- What are spanwise effects?
- How applicable are fixed-wing techniques to rotorcraft?
- What are V-22 ice shapes and what are ice shedding parameters?
- What are scaling effects for rotors and do existing scaling laws apply?
- What are the effects of forward velocity on simulations?

The assessment panel consists of Chuck Ryerson, Jim McNamara, Tom Bond, Dave Sweet, Gene Hill, Bob Flemming, Roger Gent, and Mireille Nuc.