

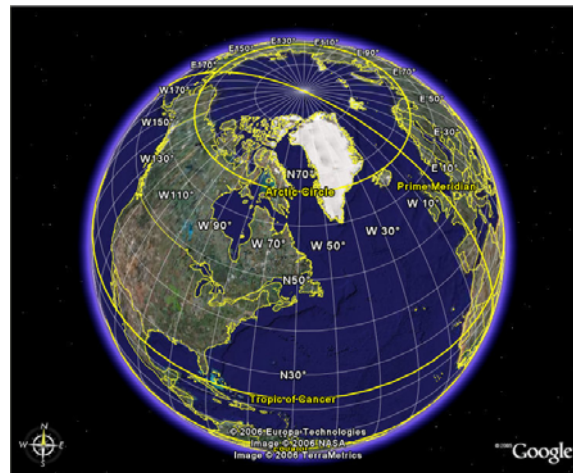
# Canadian Civil Rotorcraft Operations in Icing Conditions SAE, Seville Spain Sep 2007



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## Overview:



Canadian civil deiced rotorcraft operations  
Canadian winter climate and 'unique' conditions  
Regulations pertinent to flight in icing conditions  
Planning considerations  
Current equipment capability and limitations  
Future requirements and challenges

# Rotorcraft Operations in Canada:

Offshore Ops on the East Coast (NS & NL)

- Commuter Operations (under CAR Part VII, 704)

Air Ambulance (extensive contracted operations across Canada) + numerous ad hoc rotorcraft medevac flights

Extensive rotorcraft commuter operations on the West Coast (Vancouver & Victoria)

Aerial Work applications across Canada, extensive and increasing operations in Northern Canada in support of resource exploration and extraction, wildlife management, and defence contracts



## RW IFR Growth:



Advances in aircraft engineering, technology and performance leading to greater IFR possibilities.

Advancements in GNSS leading to greater possibilities: (increased availability of IFR airports/heliports and IFR alternates).

## Canadian Winter Climate:

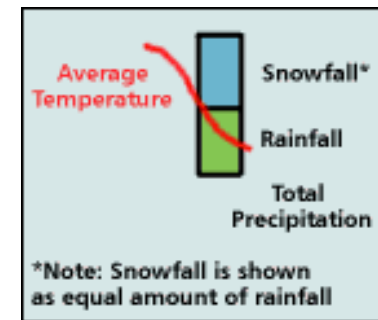
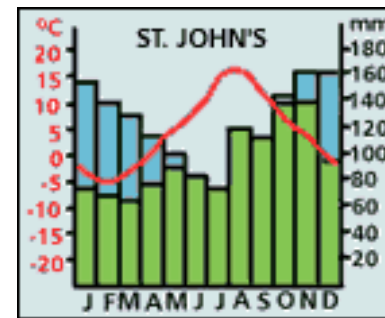
One of the coldest countries in the world.

Long winters, relatively heavy snowfall and frequent freezing precipitation events due to relatively moderate temperatures.

The Avalon Peninsula (NL) has the highest frequency of freezing precipitation in all of North America (next to Gander), in addition to being the windiest and foggiest Canadian city. More about this later...



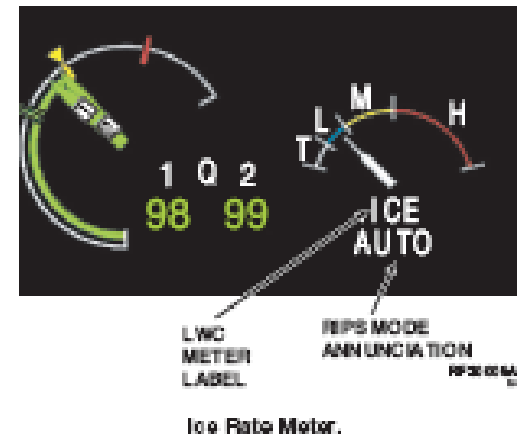
## Aviation Weather Factors:



IMC in ice forming conditions becomes a significant limiting factor as range, performance and infrastructure challenges are met.

Lack of deicing capability renders IFR/IMC impractical and/or impossible for a significant portion of the year in Canada, and particularly in Atlantic Canada where offshore oil & gas exploitation is really just beginning.

## How do we do it?



### S-92A® RFM Operating Limitations (Icing

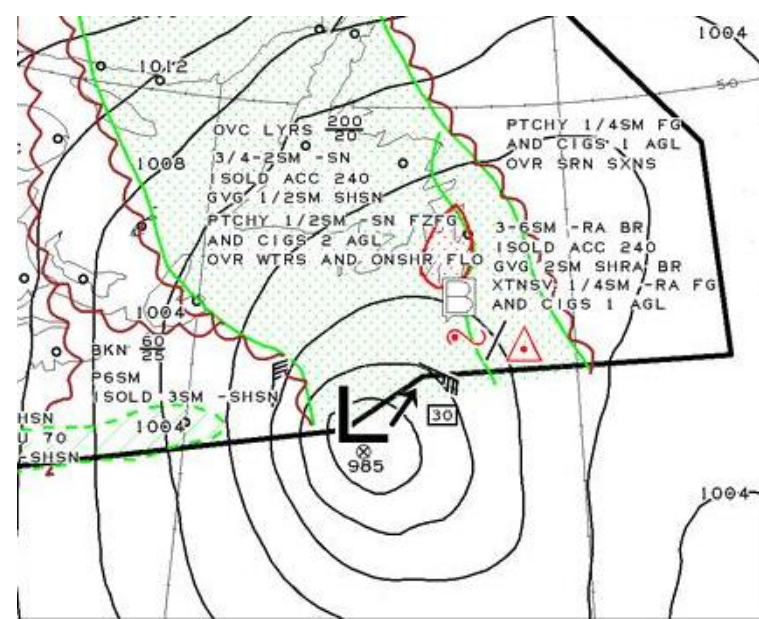
Starting with ice on the blades, engine air intakes or static vents  
*(the 'clean aircraft concept' applies)*

Flight in icing conditions without having tested the deicing system

Flight in freezing drizzle/freezing rain/super-cooled large drops (SLD) is prohibited. *(Knowledge of available pre-flight wx information plus the aircraft ice detection system helps to reduce the chances of unintentional flight into prohibited regimes – the key to avoidance is information and awareness.)*

## 'CARs' Operating Guidance:

The extent of en-route icing in cloud is assessed during pre-flight planning using the GFA Clouds, Weather, Icing and Turbulence charts.



"No person shall dispatch or release an aircraft, take-off an aircraft, continue to operate an aircraft en-route, or land an aircraft if, in the opinion of the pilot in command, icing conditions that are expected or encountered might adversely affect the safety of the flight."

**Note:** The onus is on the PIC (and Dispatcher) to assess and continuously verify the conditions throughout the flight to ensure safety.

## 'CARs' Interpretation:

Other icing conditions permitting, Cougar still requires:

An IFR alternate with **no** freezing precipitation (ZP) in the TAF for the flight period (ETA + 1 hour).

ZP can be included in the destination forecast and the aircraft can launch provided the ZP is not present at that time. (If ZP is officially observed the pilot can still make his/her own determination based on observation and file a PIREP, if justified, in order to launch.)





## Classical Signs of Icing:



Visible signs of icing – windshield, wipers, (mirrors)

Periodic variations in the vibration level

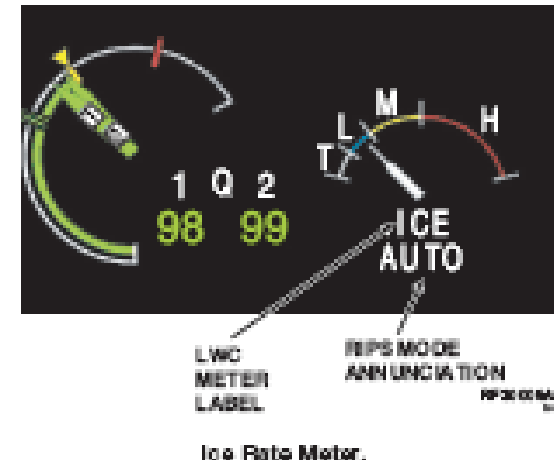
Ice detectors/sensors

Reduced stability in pitch axis

Deteriorated stability in yaw axis

Torque increase:

Note: that even with the RIPS activated torque increases  $>15\%$  are possible.



## Deiced Rotorcraft in Canada:

With all of our weather challenges and rotorcraft activity there are exactly **five** civil deiced rotorcraft operating in Canada (all presently operating CYYT & CYHZ)

Three S-92A – Cougar (CYYT)



Two AS332L Super Puma – CHC (CYHZ)



Note: Two AB139 (deiced version) reportedly on order for 'STARS'  
(Alberta's air ambulance service)

## Sikorsky S-92A RIPS:



The S-92A RIPS system uses redundant controllers and ice detectors to time the functions of the heating elements 'ON' time based on OAT and 'OFF' time based on LWC through the RIPS computer.

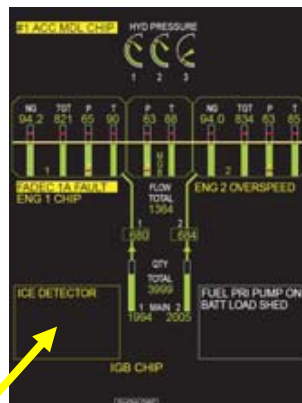
Main rotors are deiced in pairs, tail rotor blades all deiced simultaneously.

System normally in 'AUTO' mode with four manual modes available on demand.

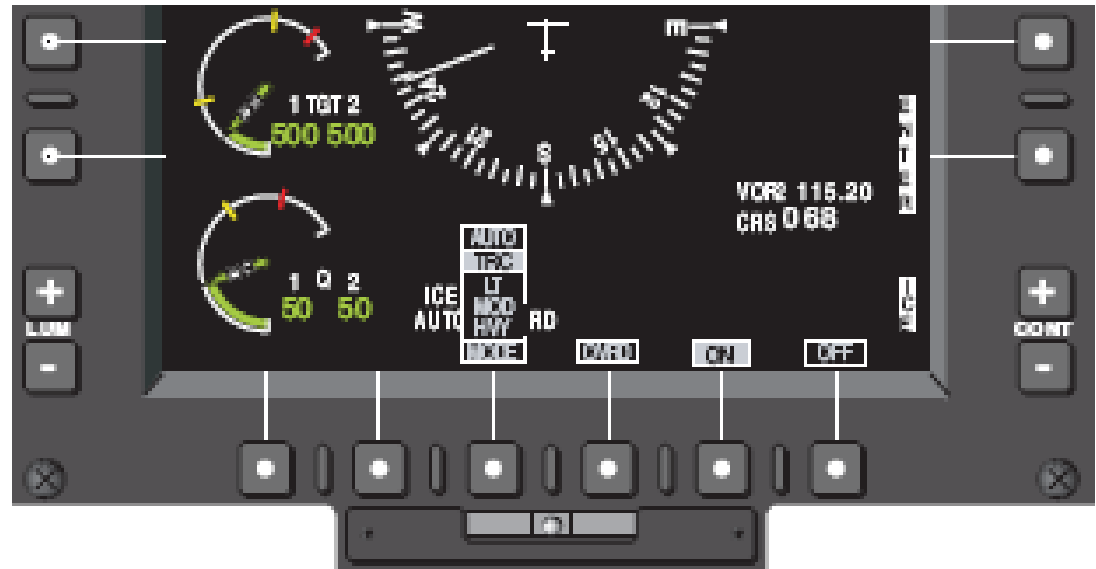
Ice Detector and display reports (indirectly) the LWC detected and the intensity of icing.

Fail safe modes provide default deicing settings in the event of controller failures.

In addition to information and control through the PFDs the EICAS system also alerts pilots to icing conditions, system faults and system status that is not appropriate to the current system settings:



**INLT 1 A-ICE FAIL**



LW METER LABEL  
RIPS MODE ANNUNCIATION

Ice Rate Meter.



# Normal PFD & EICAS displays in icing conditions:



## Typical accumulation areas:



## Sikorsky S-92A & AS332L:

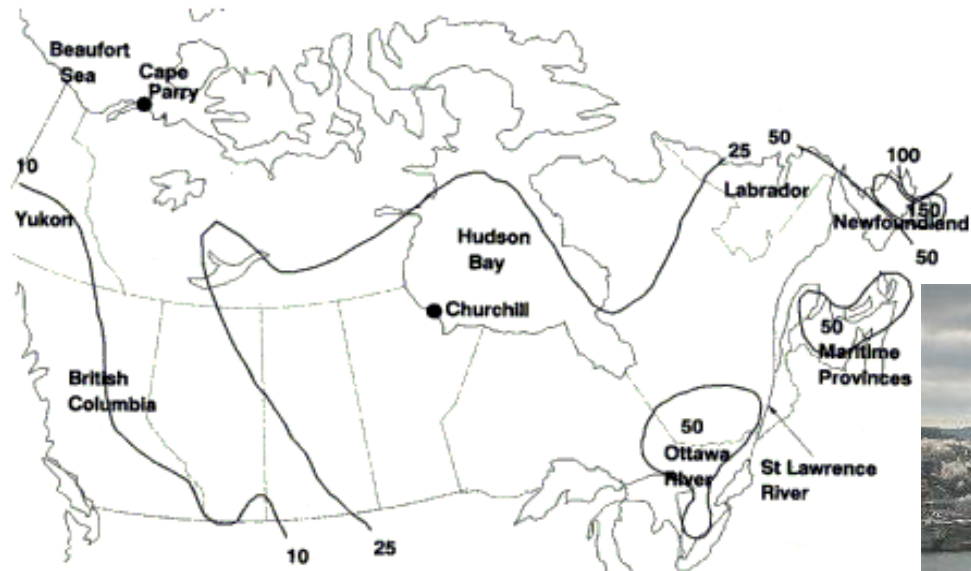


The S-92A uses a much more sophisticated controller (integrating the ice detector (LWC) with the heating control) than the AS332L which, while very effective, is used commonly as an 'anti-ice' device; i.e., heating power to the blades when ice has not yet formed.

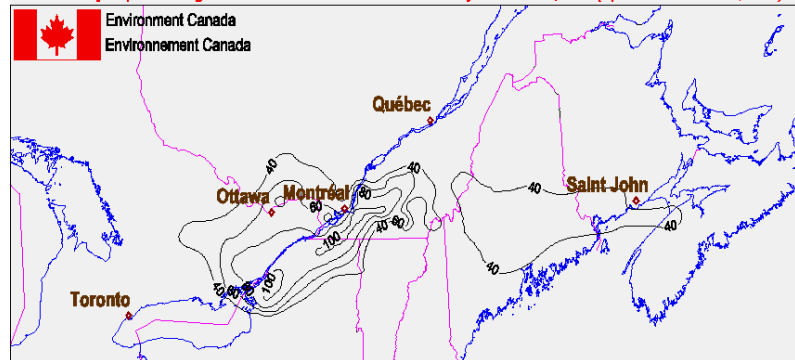
S-92A RIPS functions more as a true deice system rather than the AS332L's less sophisticated controller, which is also based on timed heat ON and OFF cycles with temperature range control).



# The Freezing Precipitation Threat:



Carte préliminaire des accumulations de pluie verglaçante en mm entre le 4 et le 10 janvier 1998 (Mise à jour du 4 mars 1998)  
 Preliminary map of freezing rain accumulations in mm between January 4th and 10th, 1998 (Updated on March 4th, 1998)



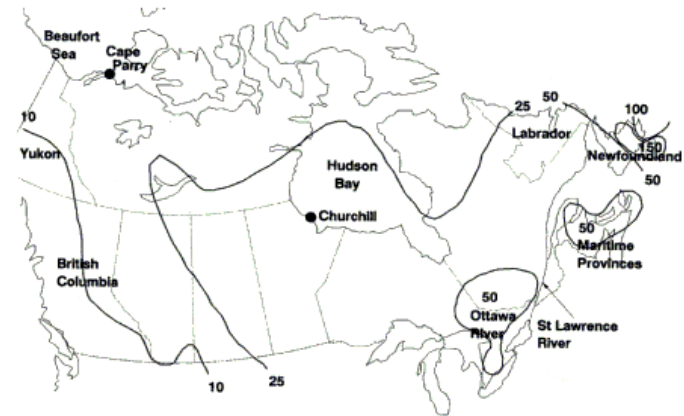
## Annual Freezing Rain Days:

Days of FZRA – CYQX 39.07 (1)

Days of FZRA – CYYT 38.62 (2)

Days of FZRA – CYHZ 12.96 (28)

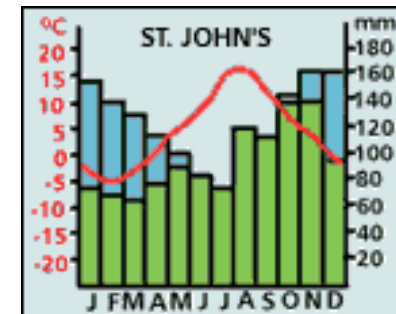
Canadian Average – 10.20 days of FZRA



## Typical Canadian Freezing Precip Events:

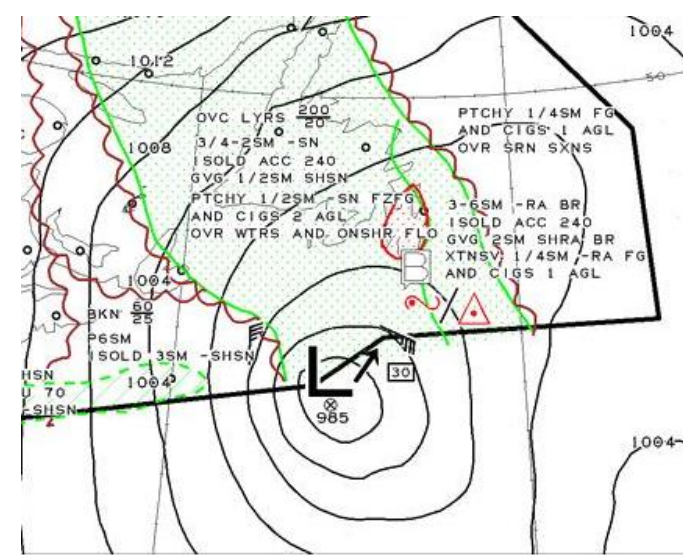
The duration of freezing precipitation events is usually 1–2 hours, but durations greater than 8 hours are not uncommon.

Freezing precipitation usually occurs with surface temperatures between 0° C and –5° C.



## Freezing Precipitation:

ZR, ZL, IP, light, moderate,  
heavy or severe...



Perhaps the biggest challenge to operators, manufacturers and regulators.

No civil rotorcraft are approved for flight in freezing precipitation.  
(Previously the AS332L was certified for flight in all but freezing rain but this was removed in the late 1990's and appears to have been a regulatory oversight)

## The Challenges:

Helicopter manufacturers should design new large and medium twin helicopters with deicing in mind. De-icing capability should be considered an industry norm for any IFR/IMC helicopter.

Meet the freezing precipitation challenge; i.e., find a practical way to achieve equivalent dispatch reliability to fixed wing ops; e.g., deicing fluids, updated certification criteria, continued and expanded testing.

Continue to advance the technology; encourage the use of state of the art materials and technology to assist in reducing weight and operating costs.

## Operators would welcome an expanded 'Envelope':

Recognize the potential and benefits of RW IFR in icing conditions:

- ⌘ Increased safety
- ⌘ Increased aircraft utilization
- ⌘ Improved dispatch performance
- ⌘ Increased earning potential
- ⌘ Increased service to customers and society

Thank you for your interest and attention!

