



Training and Technology to Improve Winter Operations Safety and Efficiency

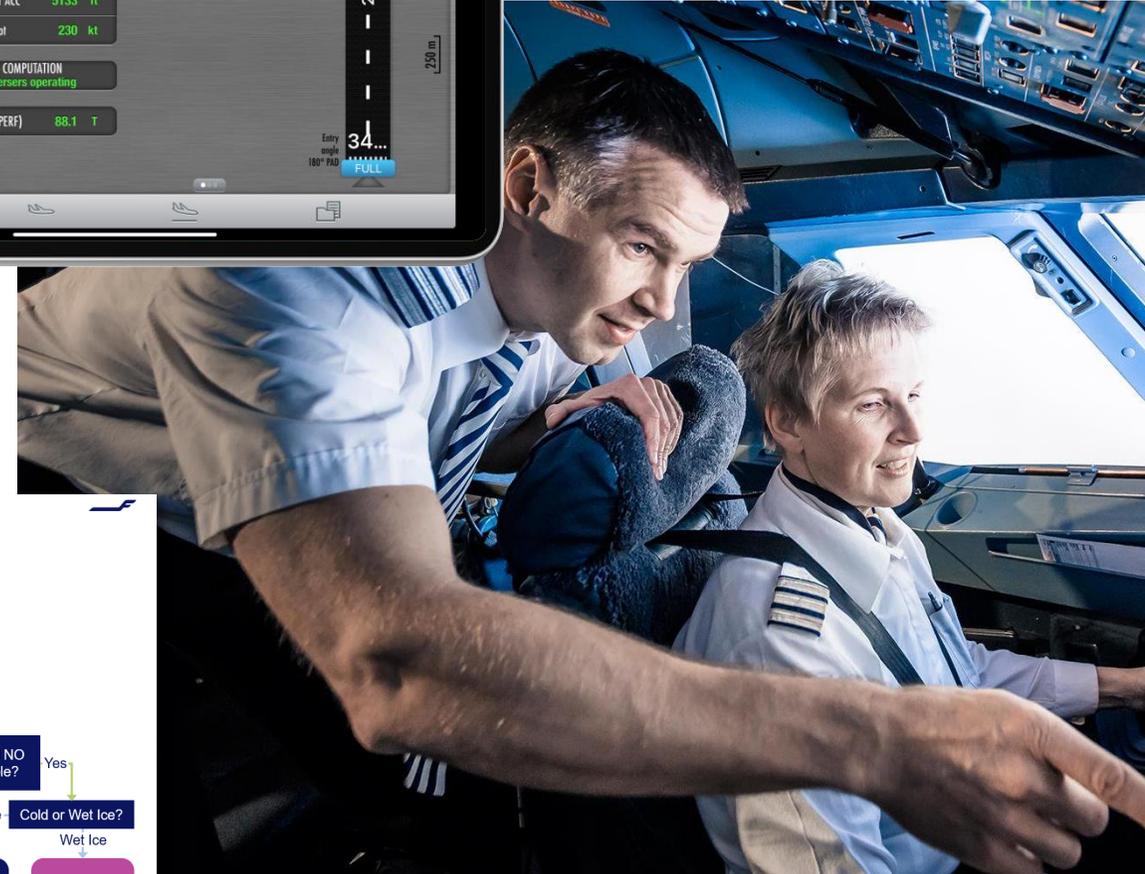


Captain Mikko Välisalo
Fleet Chief Pilot A320
Finnair Flight Operations

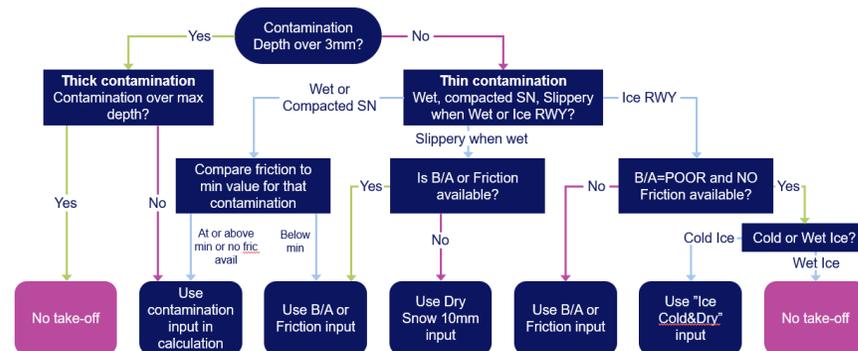


Training & Standard Operating Procedures

- Winter Operations in initial and annual recurrent CBT and simulator trainings
- Winter Operations built into SOP
- Training + Attitude = Safe Winter Ops
- Evidence Based Training (EBT)
- Guidance material easily available for pilots



Contaminated RWY for take-off



Notes:

- ESF/BA can be converted into a numeric friction value as instructed in the contamination table
- Observe Minimum numeric friction values for takeoff



EFB Application for Holdover Time (HOT) Determination

- Traditionally from various tables, but now via EFB application (or ACARS)
- Accurate weather data from sensors to measure Liquid Water Equivalent rate
- Improved safety when correct input and correct holdover time used with less pilot workload
- Sustainability by limiting the excessive use of deicing fluids and time consumed per event

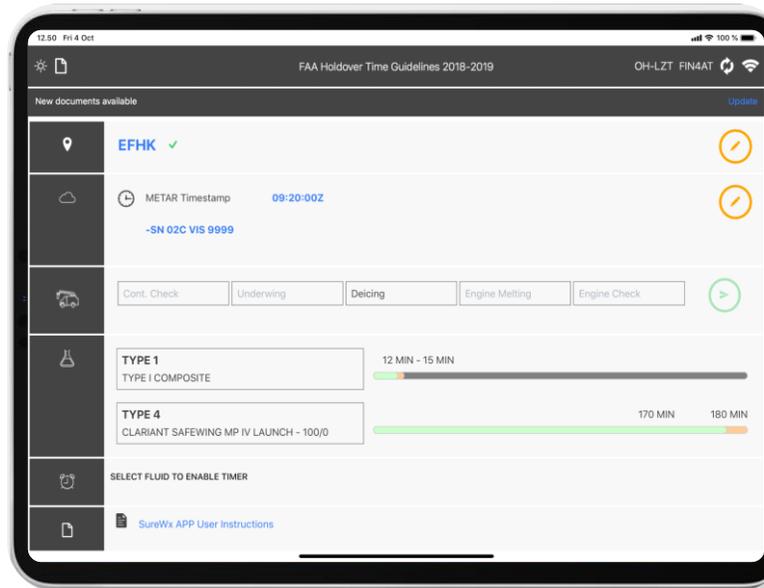


Table 1. Holdover Times For Ice Type I Fluid On Critical Aircraft Surfaces Composed Predominantly Of Composites

Outside Air Temperature (°C)	Freezing Rain rate (g/min)	Wing Icing Rate (g/min)							
≤ -2°C and above	0.00 - 0.06	0.00 - 0.06	0.00 - 0.06	0.00 - 0.06	0.00 - 0.06	0.00 - 0.06	0.00 - 0.06	0.00 - 0.06	0.00 - 0.06
below -2°C to -5°C	0.06 - 0.12	0.06 - 0.12	0.06 - 0.12	0.06 - 0.12	0.06 - 0.12	0.06 - 0.12	0.06 - 0.12	0.06 - 0.12	0.06 - 0.12
below -5°C to -10°C	0.12 - 0.18	0.12 - 0.18	0.12 - 0.18	0.12 - 0.18	0.12 - 0.18	0.12 - 0.18	0.12 - 0.18	0.12 - 0.18	0.12 - 0.18
below -10°C to -15°C	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24
below -15°C	0.24 - 0.30	0.24 - 0.30	0.24 - 0.30	0.24 - 0.30	0.24 - 0.30	0.24 - 0.30	0.24 - 0.30	0.24 - 0.30	0.24 - 0.30

| Wing Icing Rate (g/min) |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 0.00 - 0.06 | 0.06 - 0.12 | 0.12 - 0.18 | 0.18 - 0.24 | 0.24 - 0.30 |
| 0.06 - 0.12 | 0.12 - 0.18 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.12 - 0.18 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |

| Wing Icing Rate (g/min) |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 0.00 - 0.06 | 0.06 - 0.12 | 0.12 - 0.18 | 0.18 - 0.24 | 0.24 - 0.30 |
| 0.06 - 0.12 | 0.12 - 0.18 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.12 - 0.18 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |

| Wing Icing Rate (g/min) |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 0.00 - 0.06 | 0.06 - 0.12 | 0.12 - 0.18 | 0.18 - 0.24 | 0.24 - 0.30 |
| 0.06 - 0.12 | 0.12 - 0.18 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.12 - 0.18 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |

| Wing Icing Rate (g/min) |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 0.00 - 0.06 | 0.06 - 0.12 | 0.12 - 0.18 | 0.18 - 0.24 | 0.24 - 0.30 |
| 0.06 - 0.12 | 0.12 - 0.18 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.12 - 0.18 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |
| 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 | 0.18 - 0.24 |

Braking Action Computation Function (BACF)

- Aircraft itself is used to compute the actual deceleration and runway braking action
- Objective reporting via pilot reports or automatically via ACARS
- Improves reporting reliability in rapidly changing weather conditions
- How to use this valuable data in the future?



```

BRKG ACTION COMPUTED
ROLLOUT                UNIT
02000M                M/FT*
AVERAGE
2-MEDIUM TO POOR    0800M
WORST
1-POOR                0100M
AT 0700M FROM TOUCHDOWN

ONLY REPORT IF EQUAL OR
WORSE THAN GIVEN BY ATS

<RETURN                MORE>
  
```

```

DETAILED IDENT ZONES
FROM TOUCHDOWN

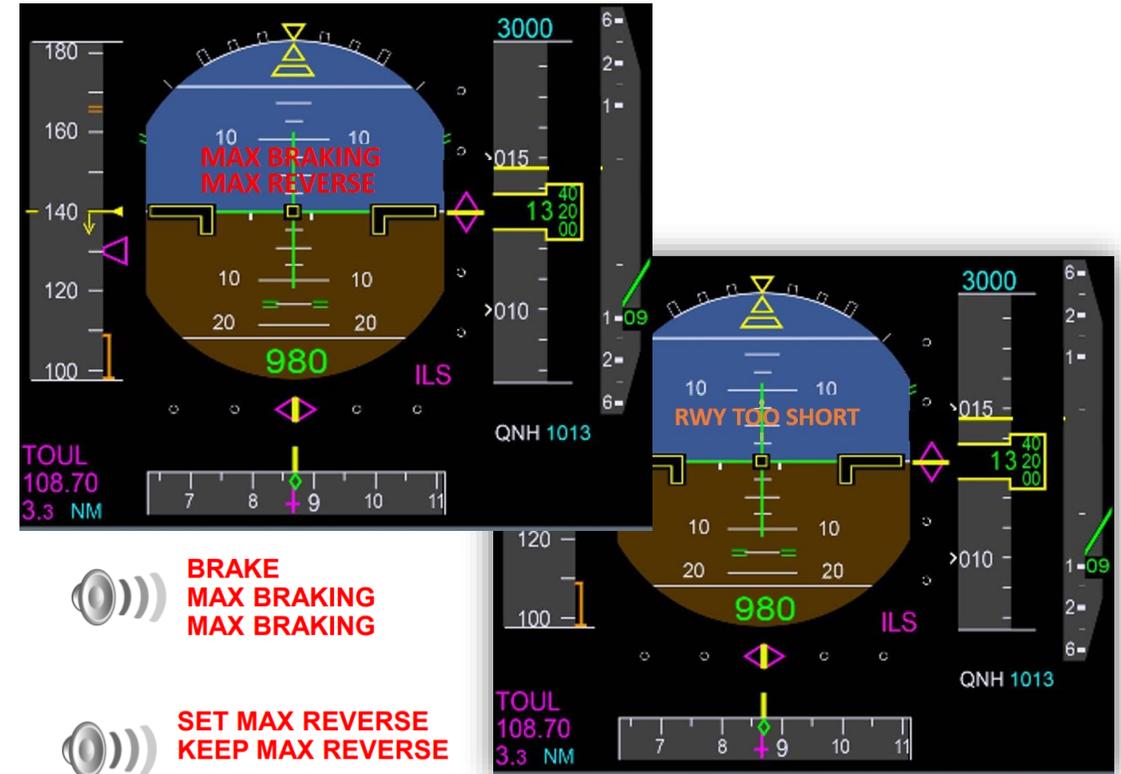
0600M/1000M
2-MEDIUM TO POOR
1200M/1400M
3-MEDIUM
1800M/2000M
4-GOOD TO MEDIUM

<RETURN
  
```

Runway Surveillance

- Takeoff Surveillance (TOS)
- Takeoff Monitoring (TOM)
- Landing Surveillance+
- Runway Overrun Prevention System+ (ROPS+)
- Brake To Vacate (BTV)
- Proposed EASA Runway Overrun Awareness and Alerting System (ROAAS)

T.O SPEEDS TOO LOW
T.O V₁/V_R/V₂ DISAGREE
T.O SPEEDS NOT INSERTED
T.O ACCELERATION DEGRADED
NAV ON TAXIWAY
NAV NOT ON FMS RUNWAY
T.O RWY TOO SHORT





Key Takeaways

- Training both flying and non-flying skills
- Enable the use of technological improvements
- Teamwork with all stakeholders

