Conclusions

1. Safety is dynamic. Production pressure constantly pushes operations towards the edge of failure.
2. Low accident frequency encourages flirting with the margin.
3. Going solid (dynamic tight coupling) makes the operating point movements large.
4. The second story: operators work to prevent the system from going solid.
5. Future safety work will explore second stories.

Disclaimer, COI

1. Views expressed are those of the speaker alone. They are not endorsed by Eurocontrol or any ANSP.
2. Conflicts of interest.
   • Travel costs and honorarium for this conference provided by Eurocontrol.
   • Travel costs and honorarium as visiting professor at Deutsche Flugsicherung on several occasions.
3. The speaker is not an ATC expert.
   (The mileage you get may vary.)

Always at the Edge of Failure

...we are talking about a law of systems development which is: *every system always operates at its capacity*. As soon as there is some improvement, some new technology, we stretch it...

*Larry Hirschhorn*

Counter-gradient
• New rules
• Recent accidents
• Safety campaigns

The operating point tends to move towards the accident boundary

What is to be done?

Getting close to the margin is a signal that the operating point needs attention.

We usually don’t know where the accident boundary is.
Normalization of deviance…

Dianne Vaughn

...moves the marginal boundary closer to the accident boundary.

The result is often a slipping of the operating point towards the accident boundary.

This is “flirting” with the margin.

If the reactor fills completely with water the system becomes hard to control.

Filling up with water is called “going solid”.

GOING SOLID

OR

Can’t go to RR because...

RR

Can’t go to ICU because...

ICU

Can’t go to ward because...

WARD

Can’t go home because...

No Ride
"Going solid"

- Either might be well-managed by itself.
- Together the combination is a safety threat. The threat will be hard to 'see' in incident reports.

"normal" OP movement

OP movement after "going solid"

What is surprising is not that there are so many accidents...

..it is that there are so few!

Operators are producing safety by decoupling the system as the OP nears the margin.
Les Liaisons dangereuses

But how? (this is the big research question in safety)

What operational tactics do we observe?

• Flexibility in resource assignment
• Dynamic restructuring of task work
• Deliberate tradeoffs (e.g. explicit goal sacrifices)
• Reactive measures

What should be the strategic approach?

• Second story inquiry (e.g. study sector splitting & other decoupling methods)
• Looking at recovery
• Better anticipation help (e.g. visualization tools)

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Thank you for your kind attention!