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Marindagen
March 19, 2009

Eric Wahren

Director Human Factors Training

- Maintenance-induced accidents in aviation
- Counteracting accidents
- Human error
- Accident investigations

Human error?

In 1928, there was a serious car accident on the main road between Örkelljunga and Åsljunga. It was a citizen of Örkelljunga that crashed into a business man from Skånes Fagerhult.

At the following trial in Klippan, the Örkelljunga citizen, who was the cause of the accident, received a reduced sentence, since he had been drinking aqvavit ar consequently had difficulties to steer his vehicle.

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Increasing flight safety

What happened to AA Flight 191?
May 25, 1979

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AA 191

- Improper maintenance procedures, forklift used for engine change – excessive strain on pylon attach points,

- Deficiencies in FAA surveillance and reporting systems, which failed to detect and prevent the use of improper maintenance procedures;

- The design of the leading edge slat system, sensitive to the damage, which produced asymmetry,

etc….

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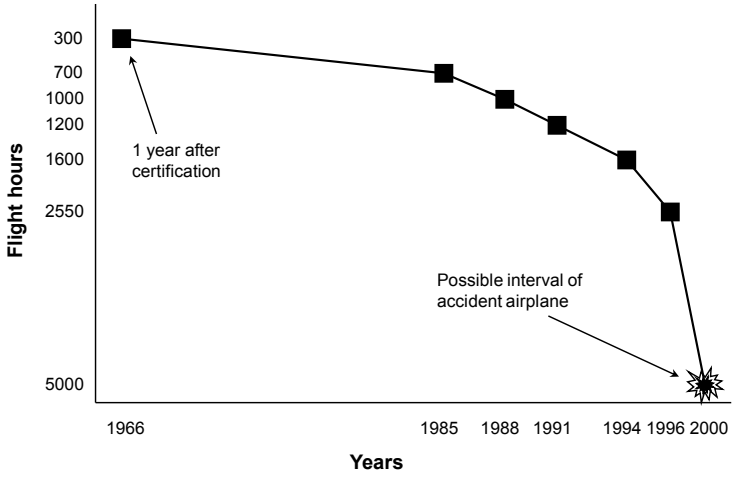
What happened to Flight 261?

Stabilizer trim actuator

- Uncontrolled expansion of lubrication intervals: From 300 hrs to every 8th month!



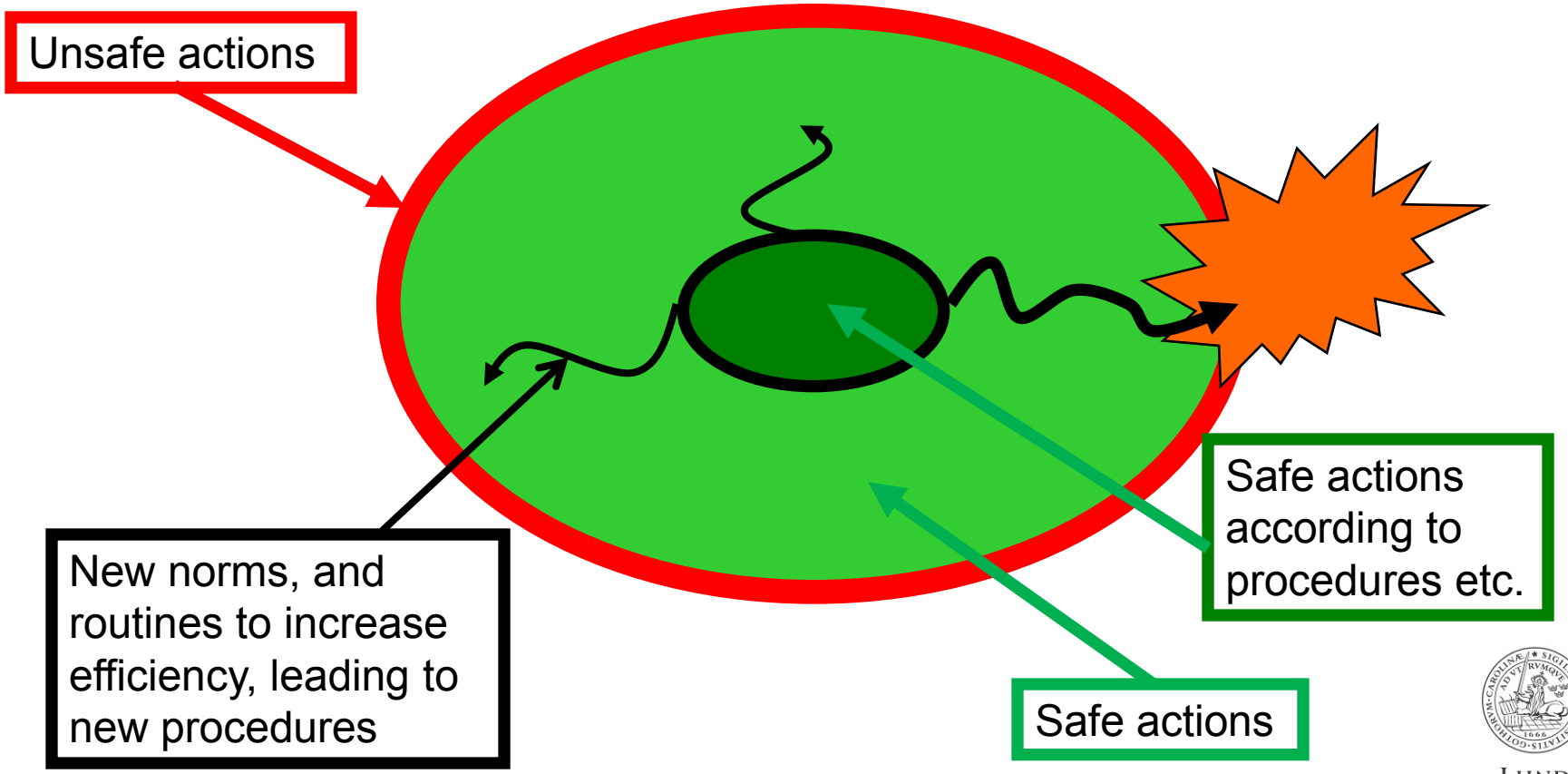
On Jan 31, 2000, Flight 261 becomes uncontrollable and plunges into the sea outside Los Angeles. All aboard were los

Service intervals

• Up to 1985: each B check:	350 hrs
• From 1985: each other B-check:	700 hrs
• 1987: B-check interval increased to 500 hrs:	1000 hrs
• 1988: B-checks eliminated: – Tasks distributed over A and C checks	
• Lubrication each 8th A check (A check every 125 hrs)	1000 hrs
• 1991: A check intervals extended to 150 hrs	1200 hrs
• 1994: A check intervals extended to 200 hrs	1600 hrs
• 1996: Lubrication removed from A check – Task card specifies every 8 months	2550 hrs

Drift to failure

Efforts to become more effective may lead to unsafe acts



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Why didn’t you speak up!?

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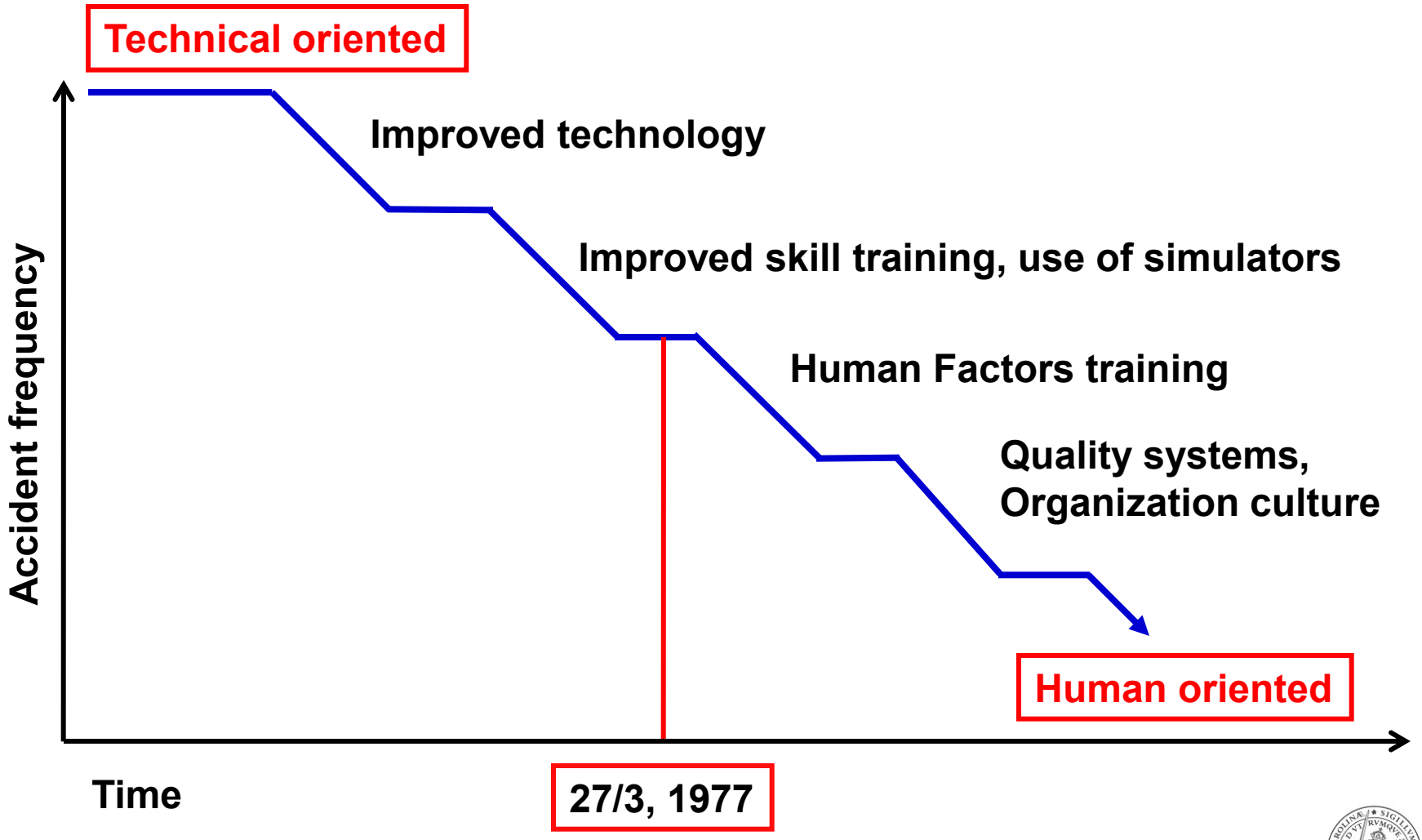
Counteracting accidents



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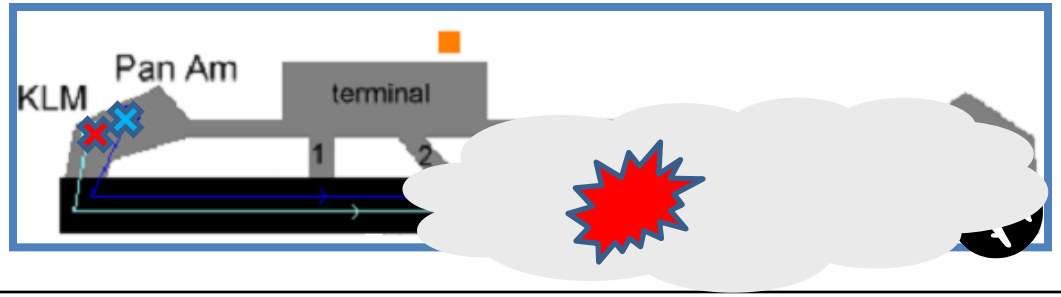
Tenerife March 27, 1977 583 people lost there life

PAA:
47,053 hrs
of crew
experience



KLM:
37,931 hrs
of crew
experience

17.06.09	Ah - Roger Sir, we are cleared to the Papa beacon, FL 90, right turn out 040 until intercepting the 325 and WE ARE NOW AT TAKE-OFF!
17.06.18	OK!
17.06.19	...and we are still taxiing down the runway - Clipper 1736
17.06.20	Stand by for take-off, I will call you!
17.06.25	Papa Alpha 1736 report runway clear
17.06.29	OK, will report when we're clear
17.06.30	Thank you

The Captain applies thrust, A/C starts to roll

17.06.32	Flight Engineer:	Is he not clear then?
17.06.34	Captain:	What do you say?
17.06.34.7	Flight Engineer:	Is he not clear then, that Pan American?
17.06.35.7	Captain:	Oh yes (with emphasis)
17.06.48	Impact	

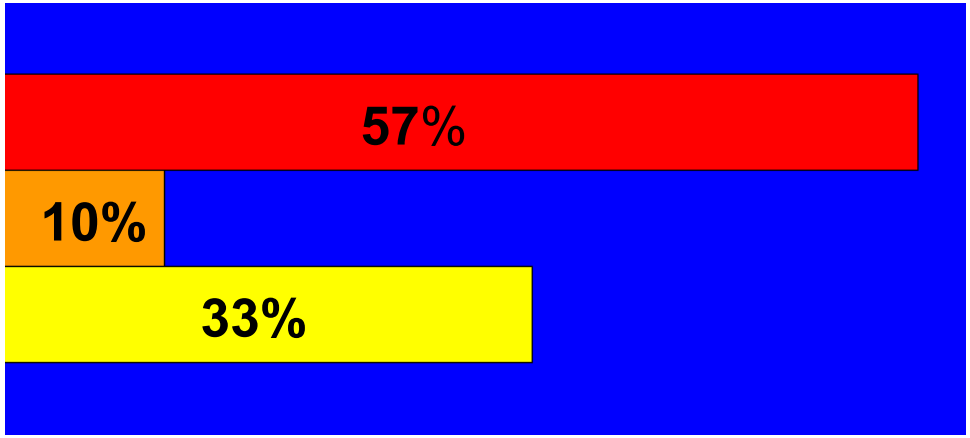
Airline pilot management errors, year 1979

(**Source**: NTSB)

Pilot management errors:

Lack of skills:

Outside control of pilot:



- **Preoccupation with minor technical problems**
- **Failure to delegate tasks and responsibilities**
- **Failure to set priorities**
- **Inadequate monitoring**
- **Failure to utilize available data**
- **Failure to communicate intent and plans**
- **Failure to detect and challenge deviations from SOP's**

Technical

and

intellectual, emotional

Attitudes!

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Crew Resource Management is…

"The use and coordination of all the skills, knowledge, experiences and resources available to the crew to accomplish or achieve the established goals of safety and efficiency of the flight."

Crew Resource Management and Maintenance Resource Management are mandatory in aviation

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What is Crew Resource Management?

”Of course I believe in crew resource management, I’m the management and you are the resource!”

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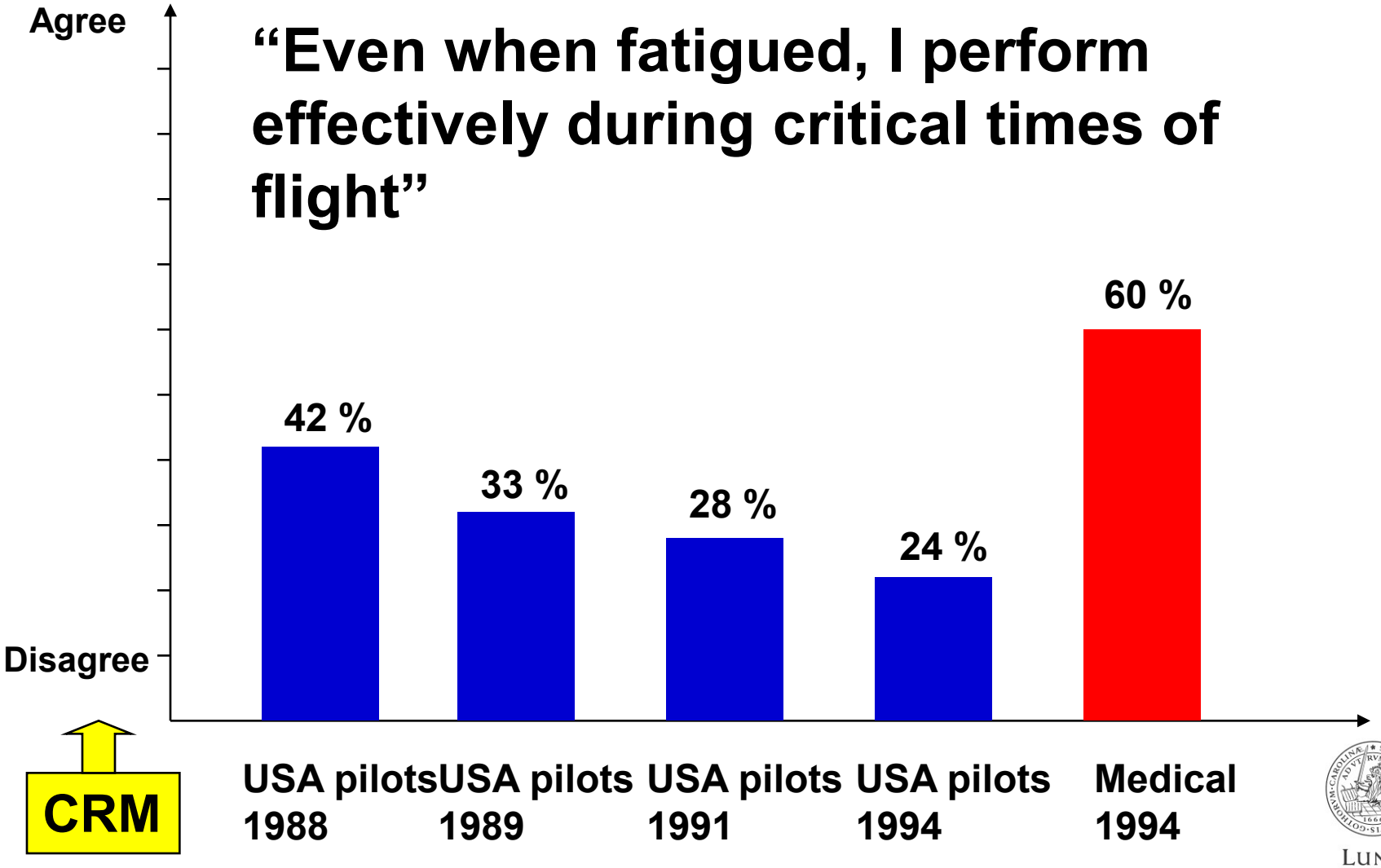
Attitude change



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Some error types

Normative errors:
Errors in assuming a role

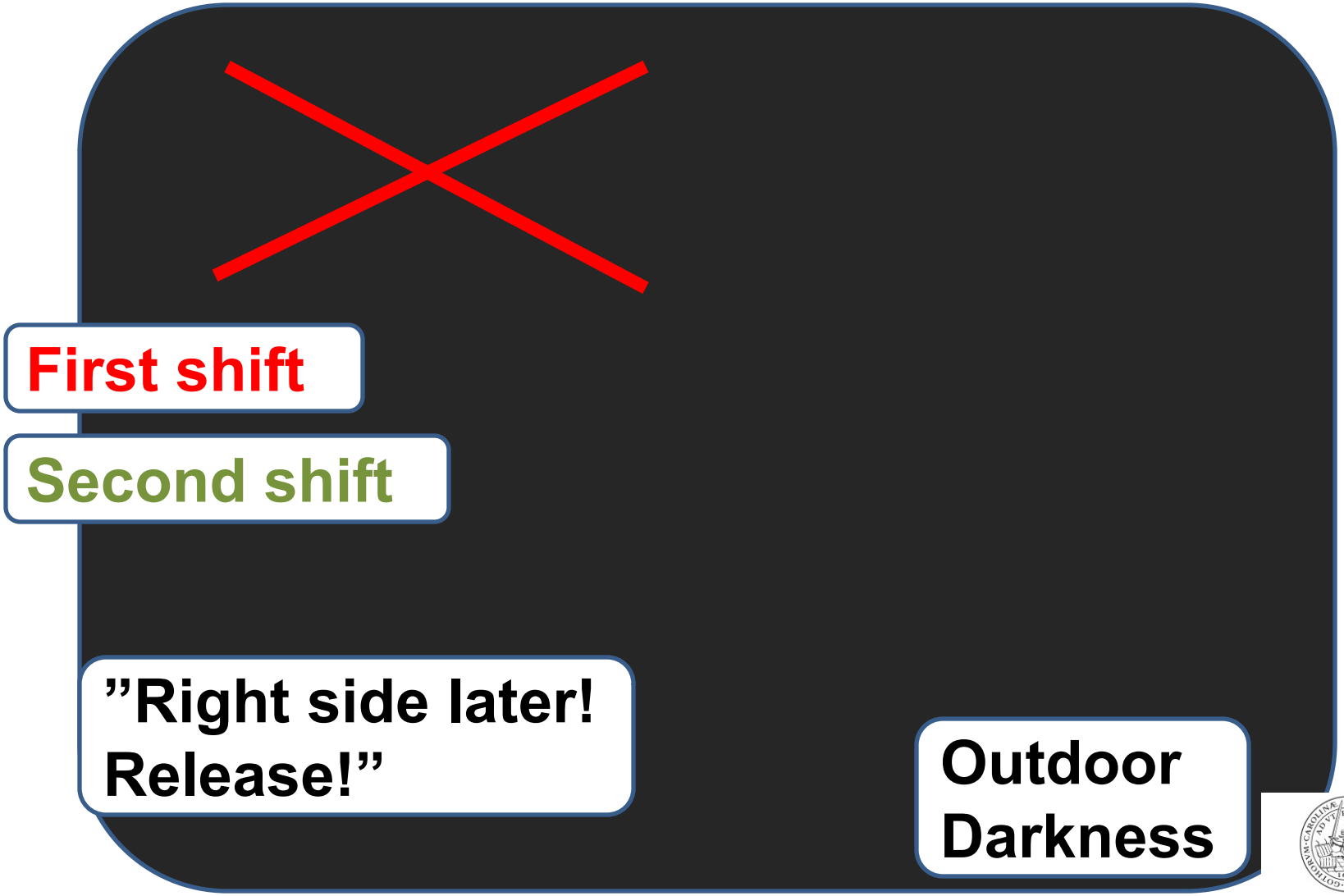
Technical errors:
Errors in a role

Latent errors

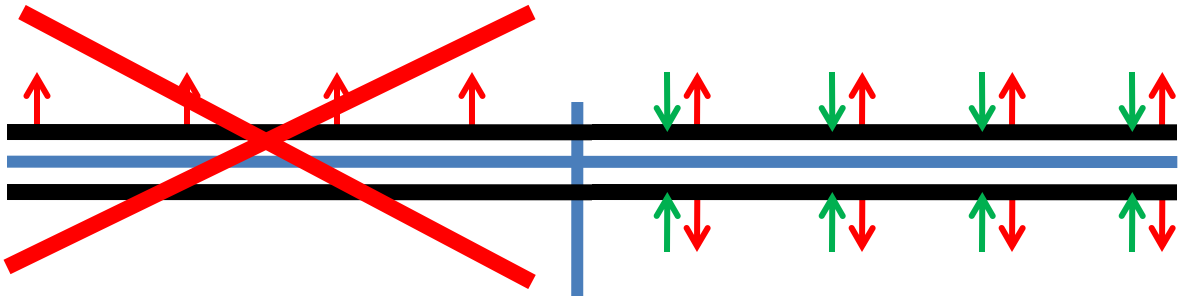
Active errors

What happened to Flight 2574?

Flight 2574: Replacement of de-icing boots



Flight 2574: Replacement of de-icing boots



First shift

Second shift

”Right side later! Release!”

Outdoor Darkness

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Flight 2574: Why?

Due to:

- Miscommunication
- Time constraints
- Poor turnover
- Work outside in darkness

...the aircraft brakes up in flight on Sep 11, 1991 at 1003.

3 crew and 11 pax are killed

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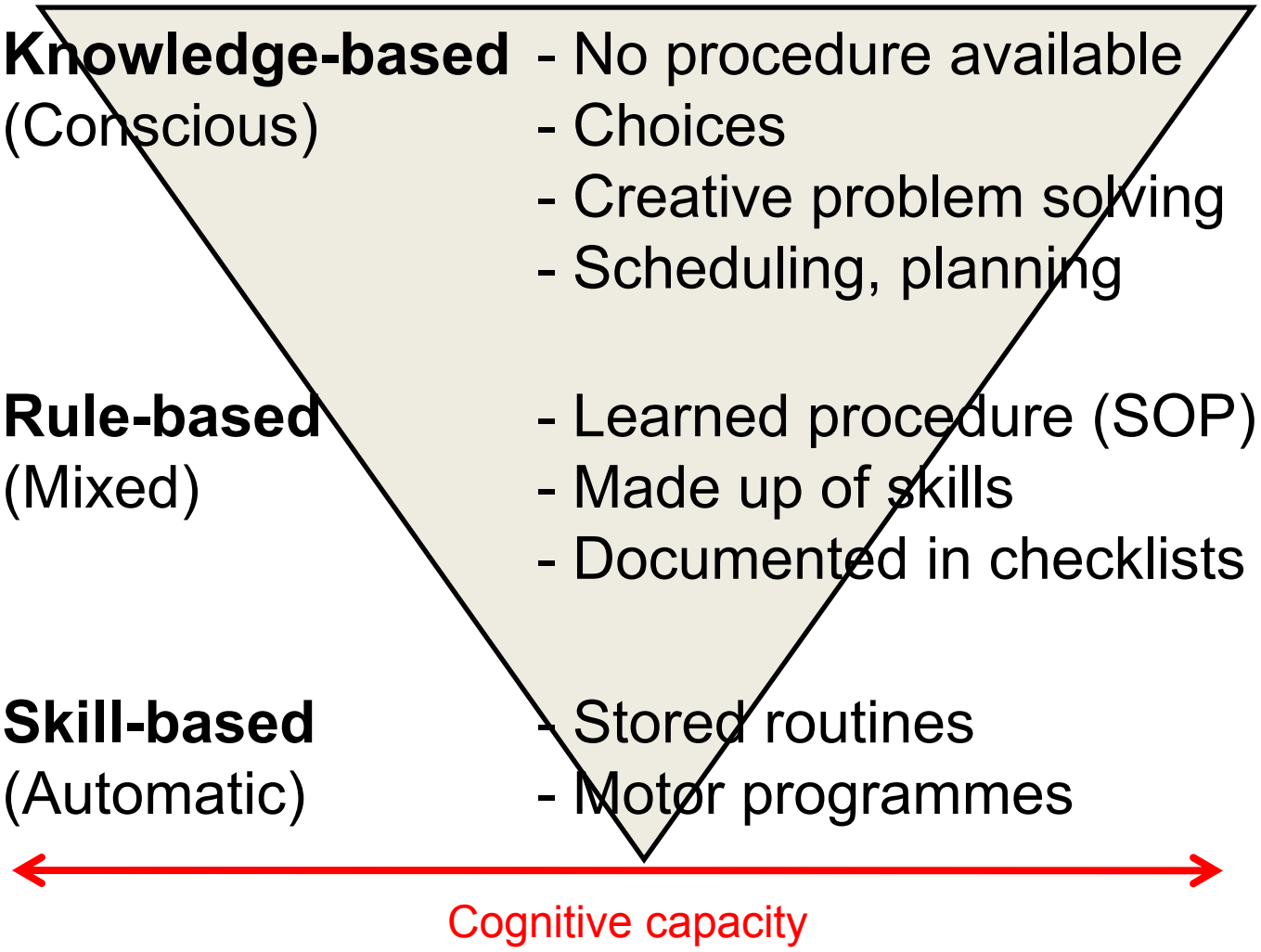
Decisions



Decisions and human error

Knowledge-based

- Incomplete analysis
- Target fixation

”Mistakes”

Rule-based

- Wrong procedure
- Forgotten action

”Lapses”

Skill-based

- Wrong sequence
- Wrong timing
- Wrong action

”Slips”

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Reasons for errors

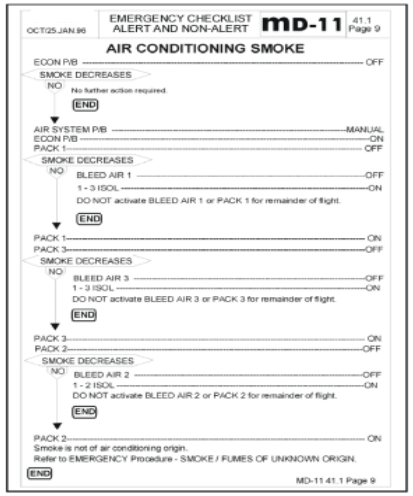
- Bad communication
- Fatigue
- Stress
- Improper attitude
- Lack of training
- Lack of experience
- Lack of information
- Bad tools

etc.

Counteracting errors

- Training
  - Non-technical skills
  - (Technical skills)
  - Recurrent training

- Checklists
  - SOP's



- Just culture

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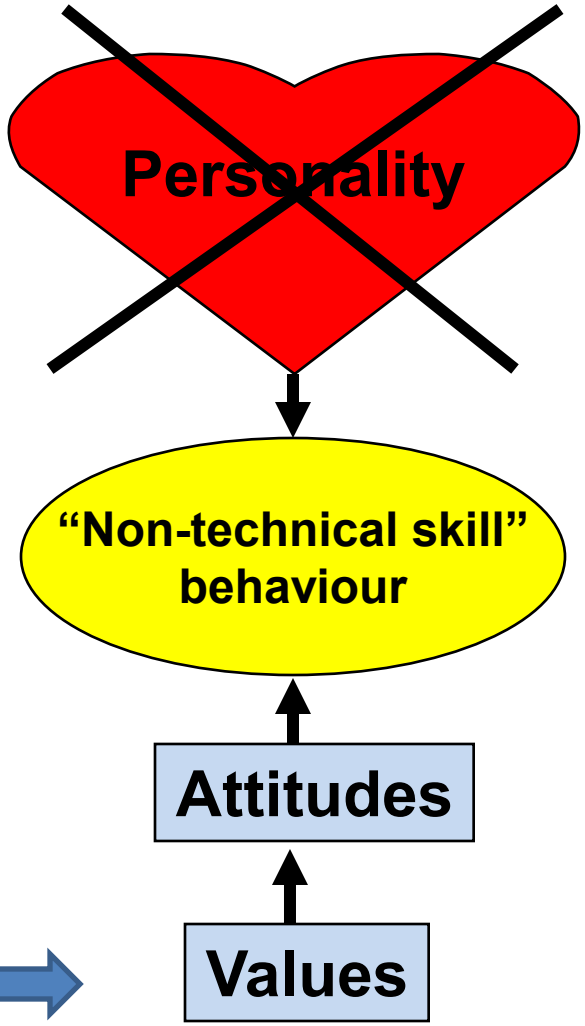
To change behaviour



CRM, MRM

Success factor: Repeated frequently!

Contents of a 3-day MRM course

1. Introduction
2. Basic Aviation Psychology
3. Attitudes and behavior
4. Culture awareness
5. Communication
6. Workload
7. Situation awareness
8. Leadership and group dynamics
9. Decision-making
10. Human error
11. The “Dirty Dozen”
12. Automation

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Training methods

- Facilitation – not instruction!
- Lectures
- Group work
- Simulations / Role –play
- Walk-through cases
- ”Dry sessions”
- Case studies

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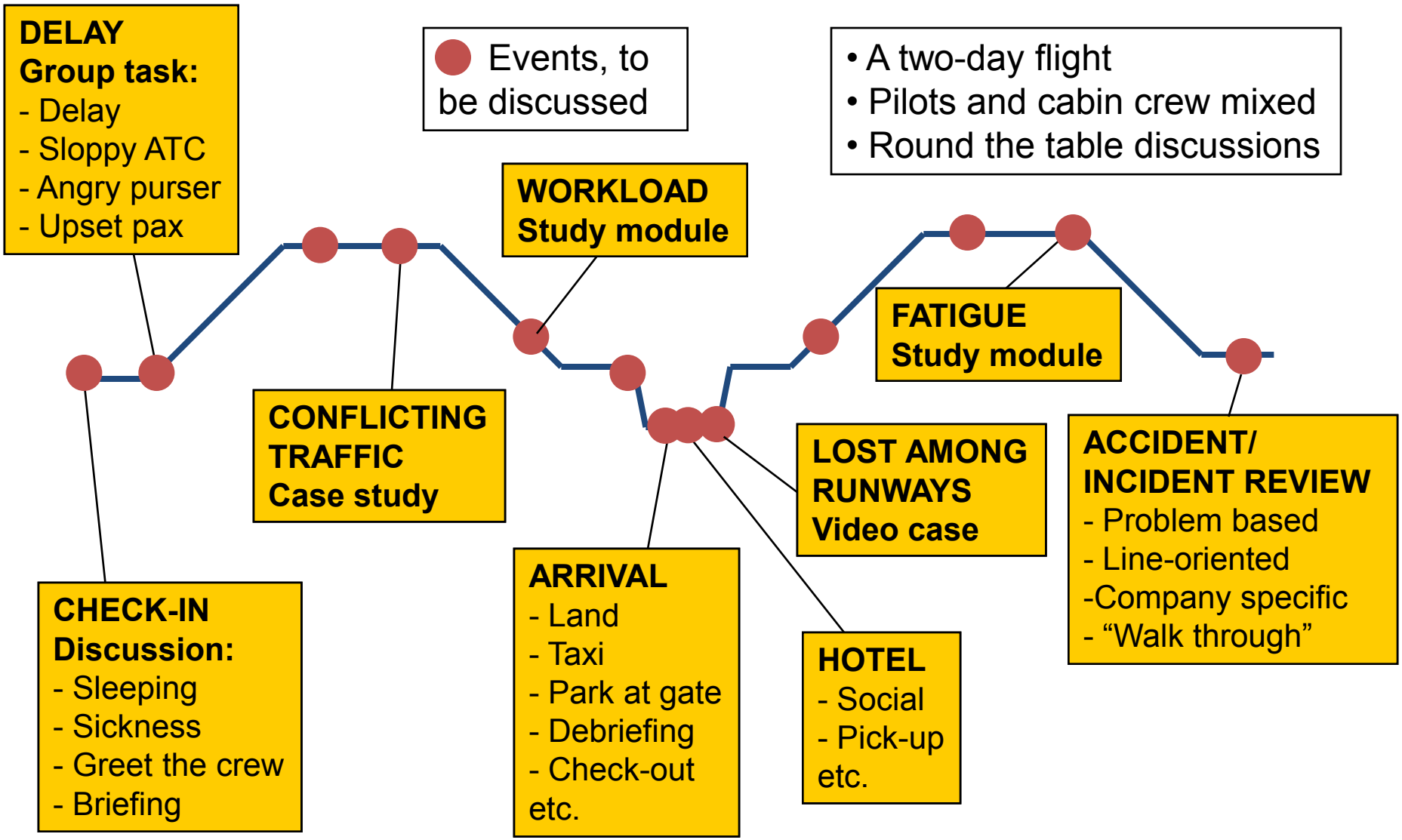
Recurrent CRM: “Dry flight”



Training method: Walk-through case

1. A situation, for which no SOP's exist

2. What should the team do?

3. What the team did in reality

4. Why did they make this decision?

5. Next phase

and so on…

”The Dirty Dozen”

(Gordon DuPont)

1. Lack of communication
2. Lack of teamwork
3. Norms
4. Pressure
5. Complacency
6. Lack of knowledge
7. Lack of awareness
8. Lack of resources
9. Distraction
10. Lack of assertiveness
11. Fatigue
12. Stress

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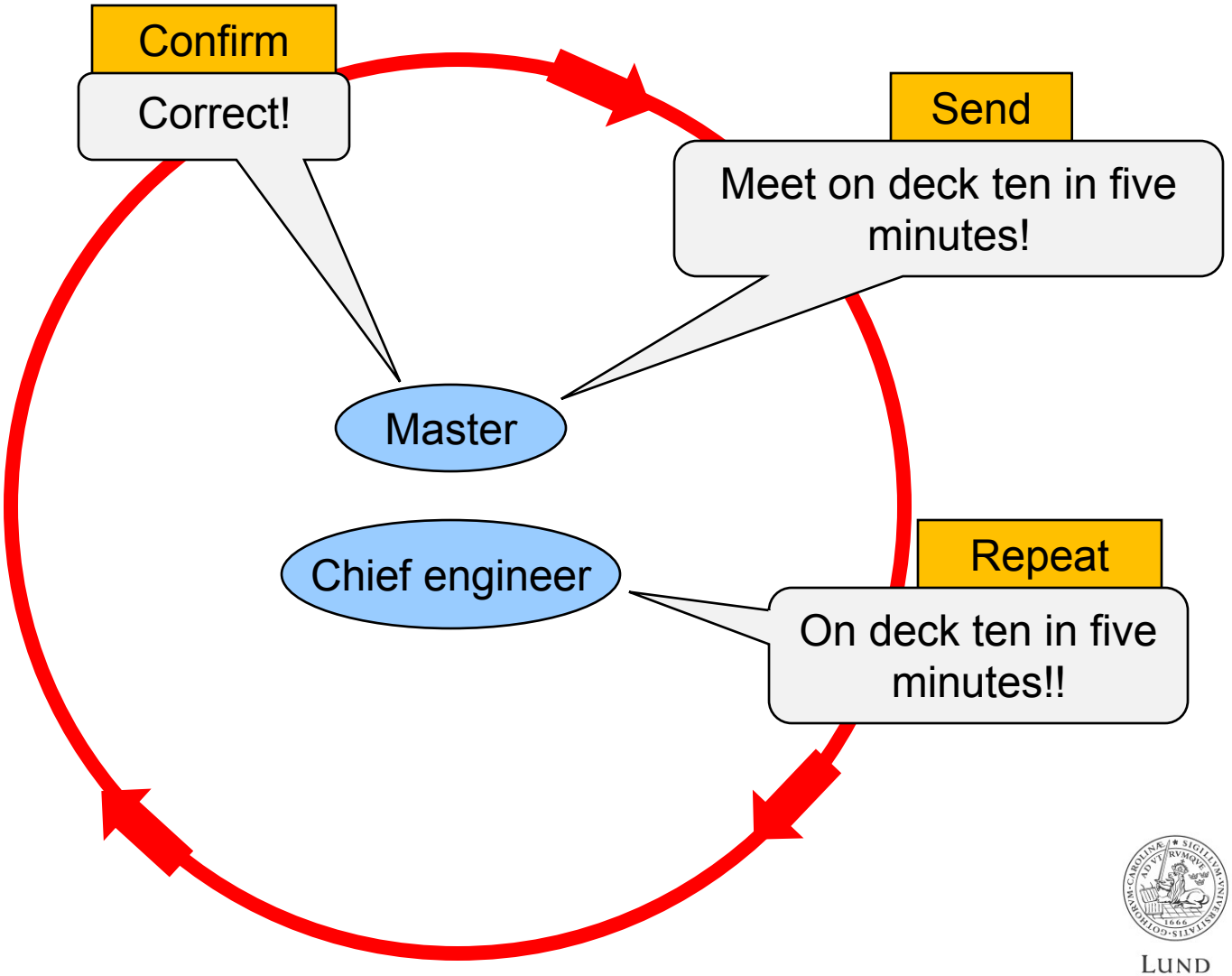
Dirty 1: Lack of communication

Closed loop communication



Dirty 5: Complacency

”A state of confidence and contentment leading to a gradual deterioration in performance with loss of critical self-appraisal”

Symptoms

- Unrealistic self-confidence
- Less desirous to remain proficient
- Personal safety less important
- Decides “on the spot”
- Decline in physical condition)

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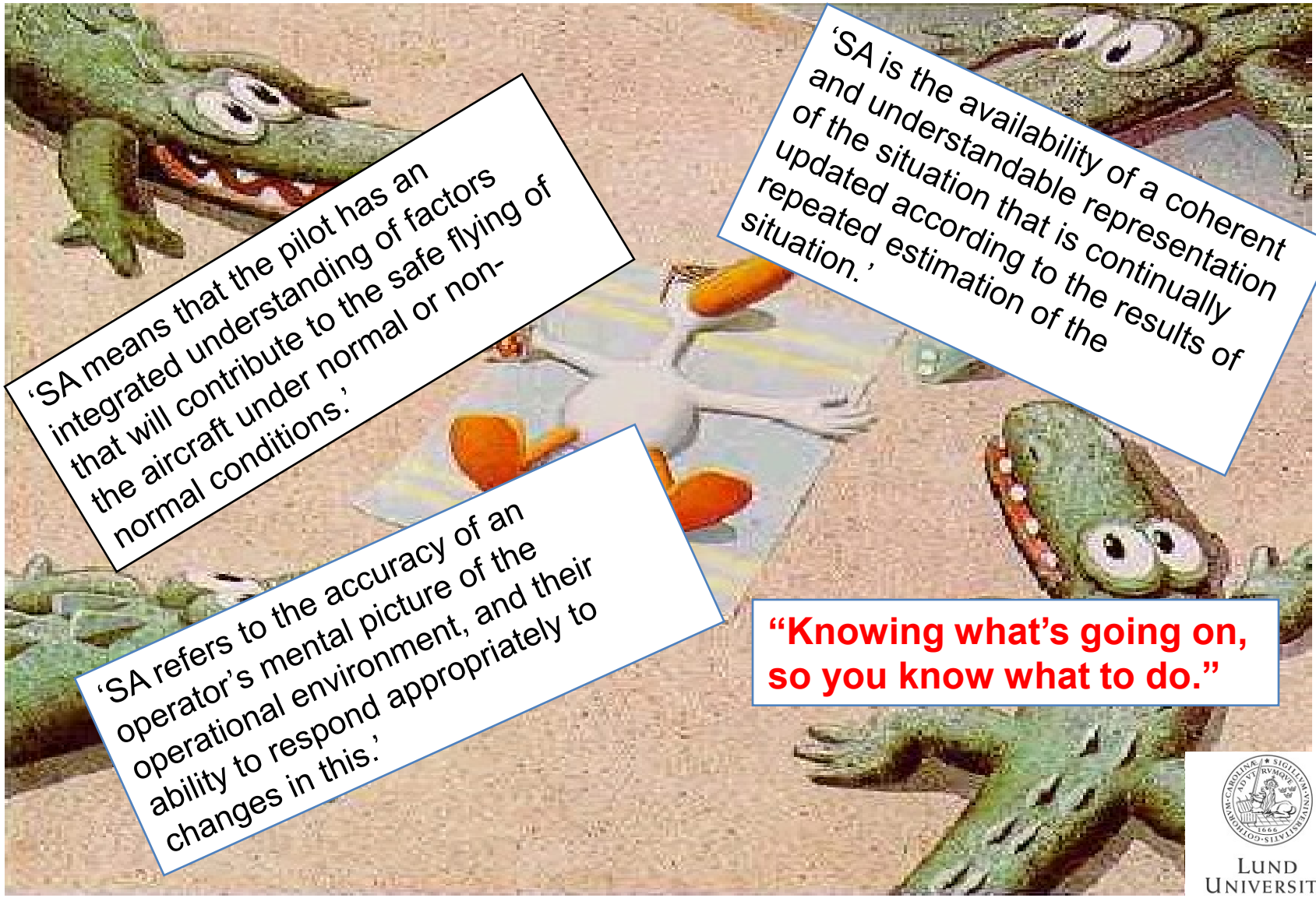
Dirty 7:Situation Awareness – what is it?



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Dirty 7:Situation Awareness

Indicators of wrong SA

- Unannounced actions or deviations from made plans
- Team communication may decrease
- Uncertainties are not resolved
- People may feel complacent

But: There may be no indications at all!!

Wrong SA is not the same as confusion!

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Just culture: Safety and accountability

- Reporting of errors supports learning and increases safety

- Punishment reduces willingness to report

- Everything can not be accepted

The Bad Apple Theory

New view:

- Systems are not automatically safe.
- People do their best to create safety and meet conflicting goals
- Human error" is the **starting point** of the accident investigation

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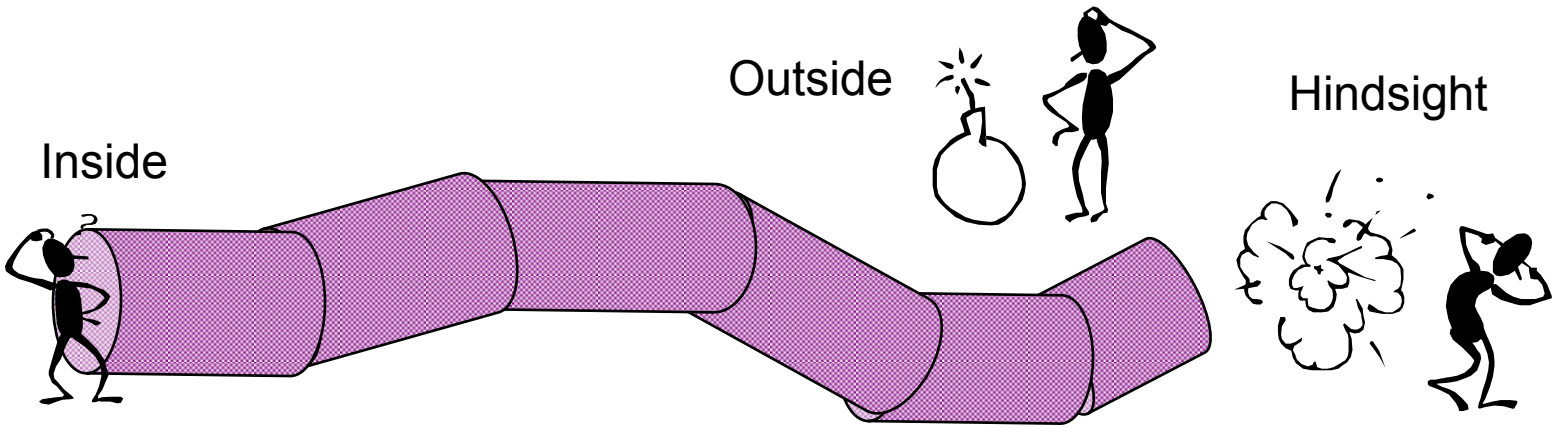
”Local rationality principle”



People do what makes sense to them at the time, given their

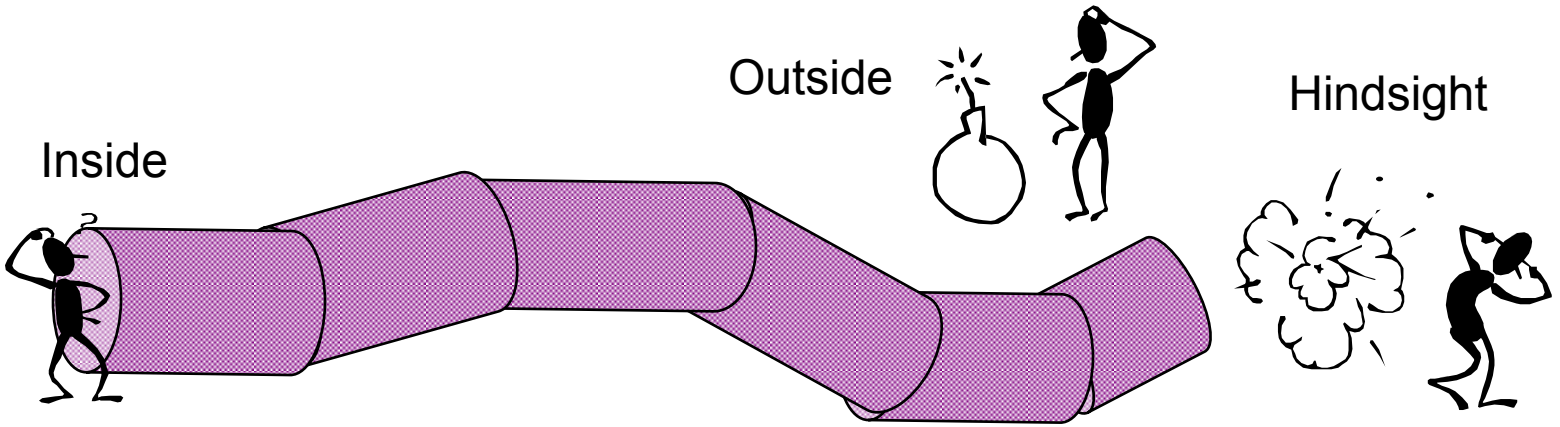
- Goals
- Knowledge
- Training
- Experiences
- Attitudes
- Communication abilities
- Information
- Physical condition (fatigue)
- Stress
- Focus of attention
- Tools

etc.

Accident investigation

The point is <u>not</u> to find where people went wrong

It is to understand <u>why</u> their assessments and actions made sense at the time



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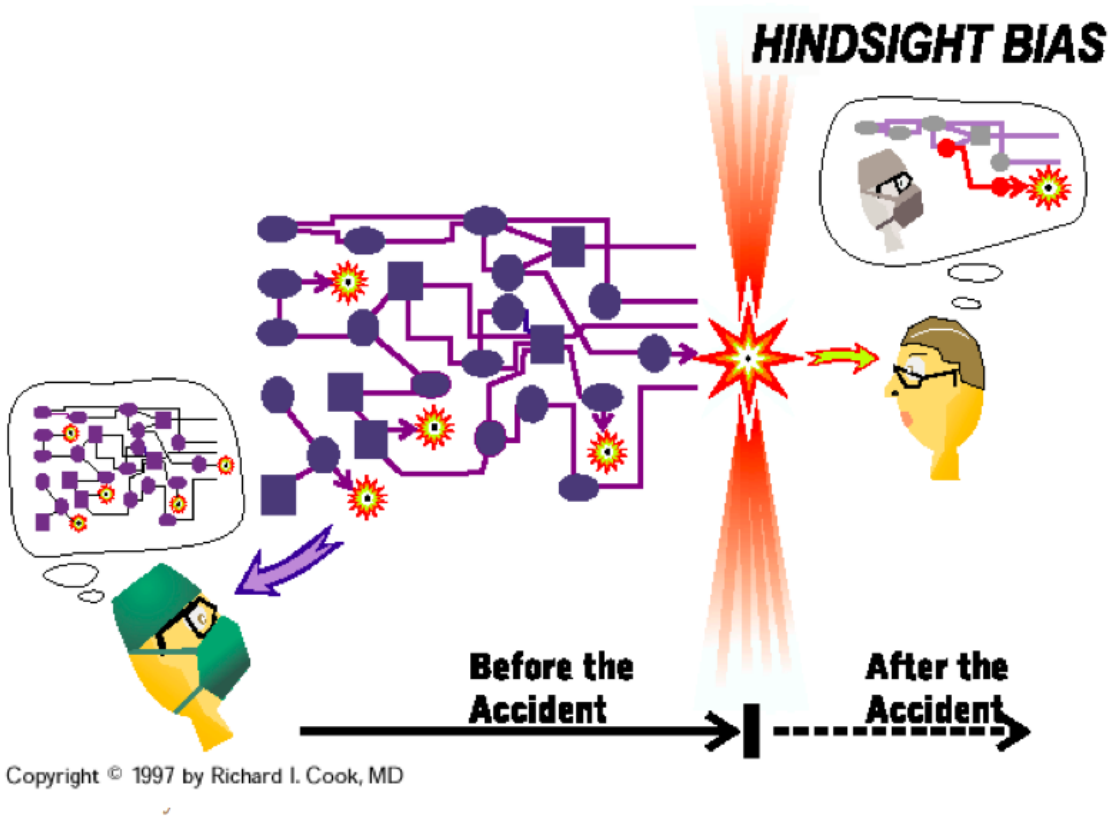
In hindsight



Against action - obvious

Pro action – not so obvious

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The resilient team

- Does not take success in the past as a guarantee for future safety
- Keeps the discussion about risk alive
- Listens to all ideas and inputs
- Prepared to invest in safety
- Problem-solving is continuous, no ”thematic vagabonding” or ”cognitive fixation”
- Allows changes

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Are we prepared to change?

"Without changing our patterns of thought, we will not be able to solve the problems we created with our current patterns of thought."

Albert Einstein

Thank you!

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