



2º Simpósio Internacional de Confiabilidade e Gestão de Segurança Operacional

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**Organização Brasileira
para o Desenvolvimento
da Certificação Aeronáutica**

10 Myths of Aviation Human Factors and Safety



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10 November 2010

*Simpósio Internacional de Confiabilidade e
Gestão de Segurança Operacional
SJ dos Campos, Brazil*

The Dédale Group

- **HQ in Paris, France**
- **Offices in Melbourne, Toulouse**
- **Core activities include:**
Human Factors & Safety training development, consultancy and research, in
 - ❖ **aviation, health care, maritime, mining, rail, road safety, nuclear power industry, gas distribution**
- **Shareholder senior consultants include:**
 - ❖ **Jean Pariès**
 - ❖ **Professor James Reason**
 - ❖ **Professor Erik Hollnagel**
- **Since 1992**

Dédale clients include...



Aviation:

- Airbus
- Air France
- Air Pacific
- Australian Defence Force
- ATR
- Cathay Pacific Airways
- Civil Aviation Safety Authority
- DGAC
- EMBRAER
- Emirates Airline
- EUROCONTROL
- QANTAS Airways
- Singapore Airlines
- South African CAA
- TAP

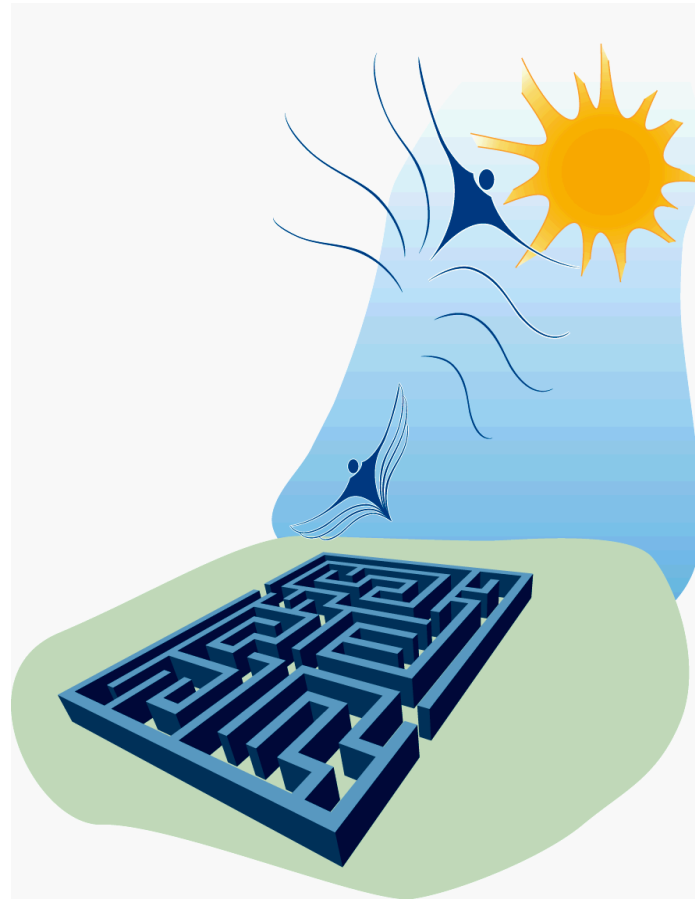
Rail:

- Australian National RRM Project
- Public Transport Safety Victoria
- NSW Independent Transport Safety & Reliability Regulator
- SNCF (French National Railways)
- Rail Accident Investigation: F, L, B

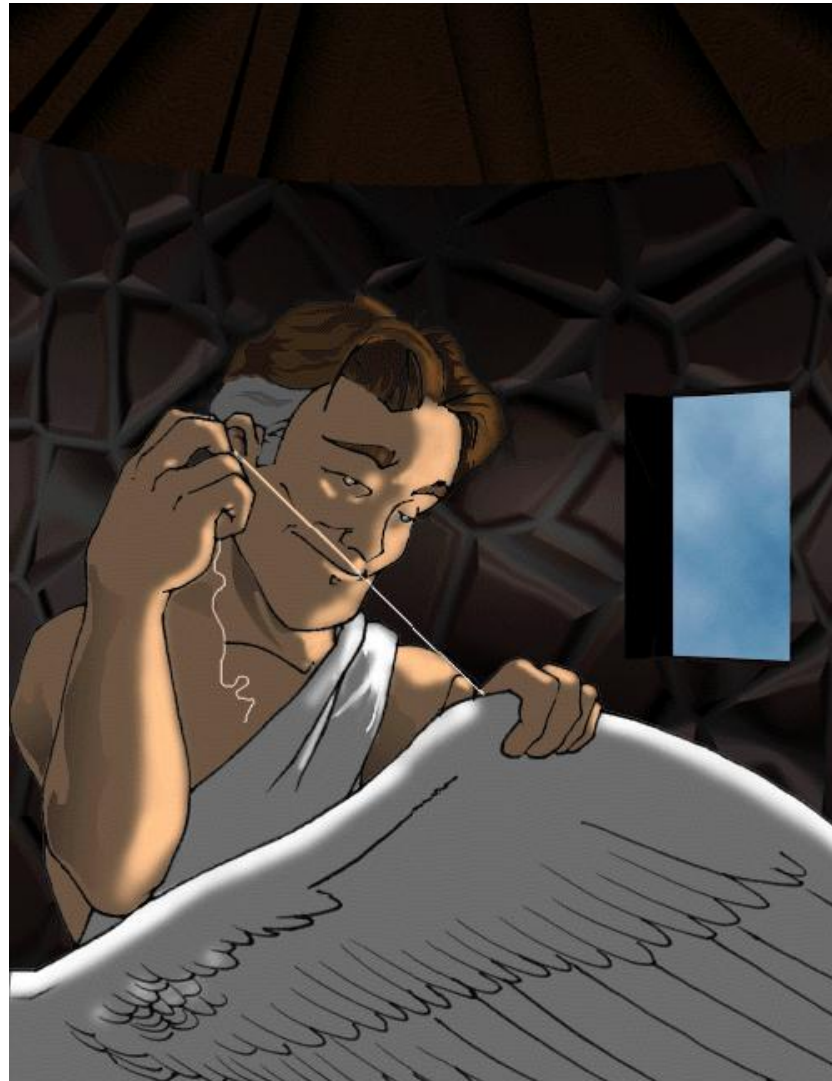
Other:

- EDF
- Nuclear Safety Authorities: ASN, SKI
- Paris Hospitals; Geneva Hospital
- BHP Billiton
- Fire Fighting Services
- Maritime companies
- Renault
- ...

1 - The Myth of Daedalus ...



The First Manufacturer



The First Flight?



The First SOP?

*Daedalus warned Icarus **not to fly too close to the sun**, as it would melt his wings,*

*and **not too close to the sea**, as the spray would dampen them and make it hard to fly*



The First Violation?

But Icarus was exhilarated by the thrill of flying and began to soar higher and higher.

Flying too close to the sun, the wax holding his wings together melted from the heat and he fell to his death in the sea below...

The First Air Accident?



The Myth of Daedalus ...



Understand your
limitations



Operate within
them

Keep control on
complexity

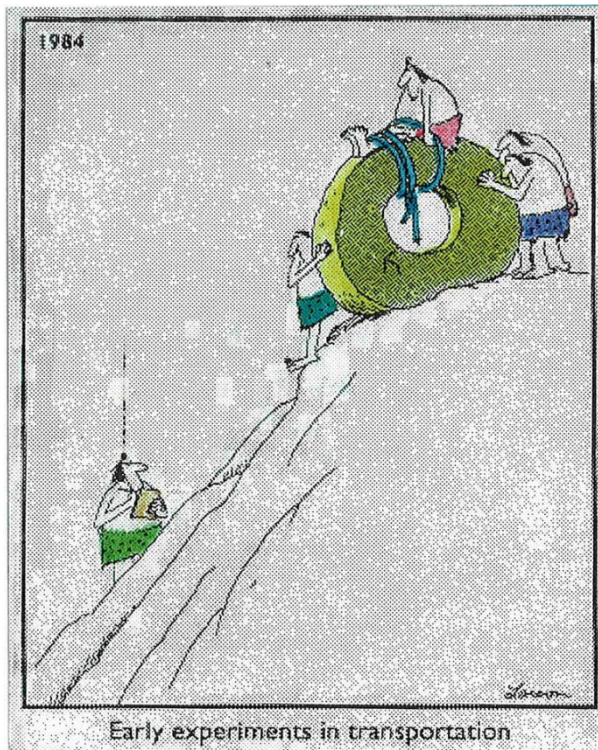
Think outside the
box

Myth 2: People are the problem

Human error contribution to accidents estimated at between 70-100% for most well-defended, hazardous technologies

Hardly surprising since people

- **Design**
- **Build**
- **Operate**
- **Maintain**
- **Manage**
- **Regulate these systems...**



People create safety



Myth 3: Errors cause accidents...



- **Most errors have no serious consequence**
 - ❖ **About one air accident for every 20 million errors**
- **Why? All operators dynamically manage risks:**
 - **regularly deal with unexpected events, manage errors, violations and abnormal situations**
 - **make good decisions and show good judgment**
 - **recognise potentially dangerous actions and situations: “knowing the limits”**
- **Errors help safety: they identify risky activities, the ‘edges’ of safe behaviour, and teach us to be careful**

The context is more important than the error

The same error can result in very different consequences, depending on the context



The rule is more important than the error

Se sua configuração estiver desta forma,
basta clicar no Internet Explorer que irá abrir
a tela do navegador solicitado usuário e
senha

We still need to try and comply with rules!

Myth 4: Errors can be eradicated

- **We can't simply tell people to stop making errors:**
 - "be more careful / vigilant / etc..."
- **Errors are not within our conscious control**
~ part of the **'human condition'**
- **We can't change this** about people
- **We can change the conditions** which promote / allow errors
- **But most errors will continue to happen**

Myth 4a:



'True Professionals' don't make mistakes

- Some of the simplest errors are made by the best people:
 - Experienced crew members, supervisors, etc.



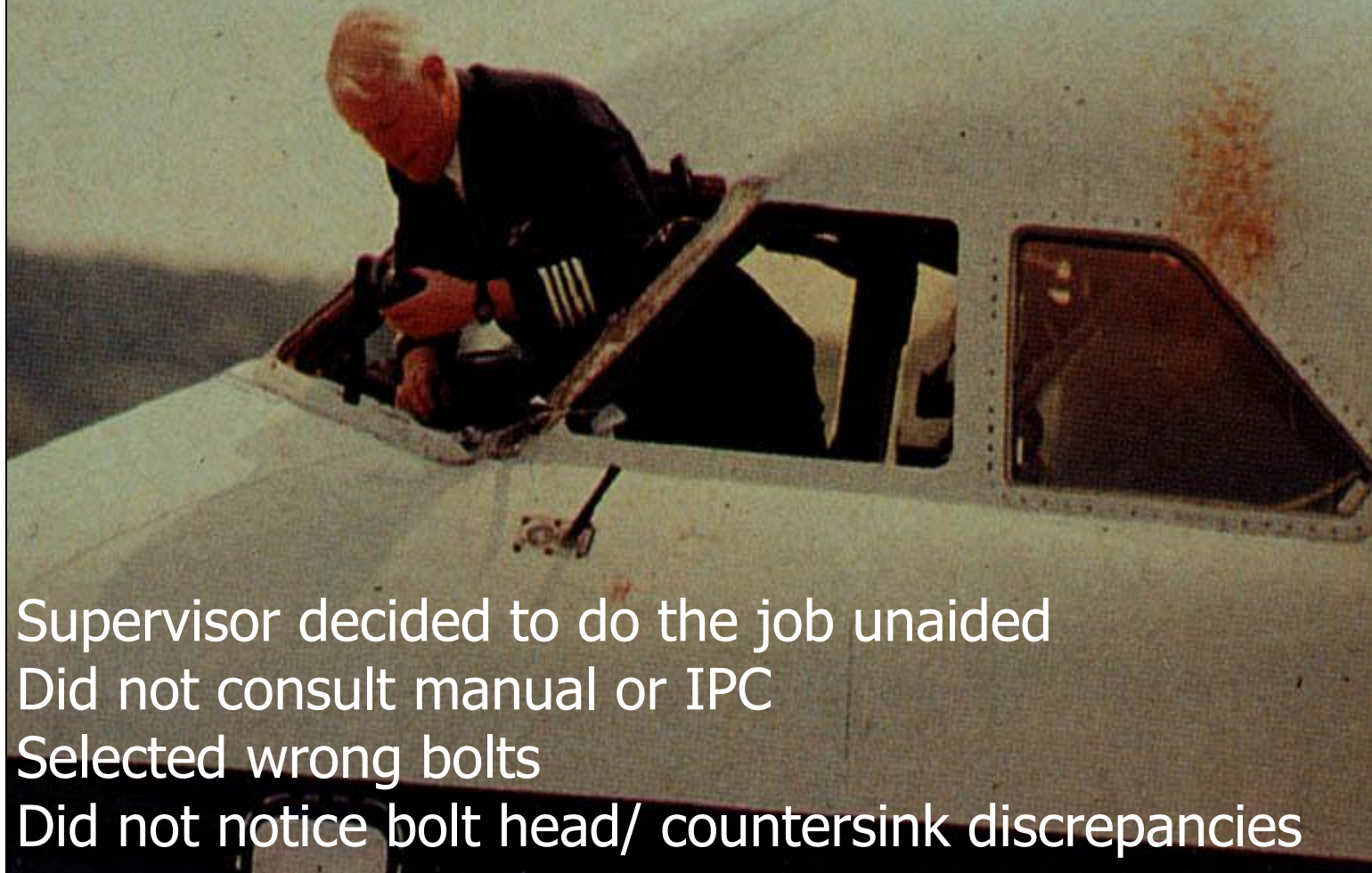
Myth 5:

'Real men' are unaffected by fatigue, stress, etc...

- Compared two groups:
 - ❖ One, kept awake for 28 hours
 - ❖ Second, consumed 10-15 grams of alcohol at 30 minute intervals until MBA content reached 0.10%
- Cognitive psychomotor performance of both groups measured every 30 minutes
- For sleep deprived group: After 17 hours of sustained wakefulness, performance decreased to the level found at a BAL of 0.05%
- At 24 hours, equivalent to BAL of 0.10%

Myth 5a: Supervisors do not need supervision

June 1990: British Airways BAC 111 Windscreen Blow Out



Supervisor decided to do the job unaided
Did not consult manual or IPC
Selected wrong bolts
Did not notice bolt head/ countersink discrepancies

BAC 111

Organisational Issues

- **Night shift**
- **High workload**
- **Understaffed**
- **Proper stand not available**
- **Torque wrench not available**
- **Inadequate labelling of parts, poor lighting**
- **No dual inspection**
- **Aircraft not pressurised after window change**



(Hobbs, 2005)

Myth 6: Technology will fix our 'Human reliability problems'

- Advances in technology have been very effective

- However

- FMS
- GPWS (pre-EGPWS)
- TCAS, HUD, TAWS,
- EFB, etc.



- They have also had perverse effects
 - e.g. loss of skills, overconfidence, big surprises...
- The key issue: human-machine interaction

Myth 7: An SMS will fix all our problems...



BP Deepwater Horizon explosion, 20 April 2010

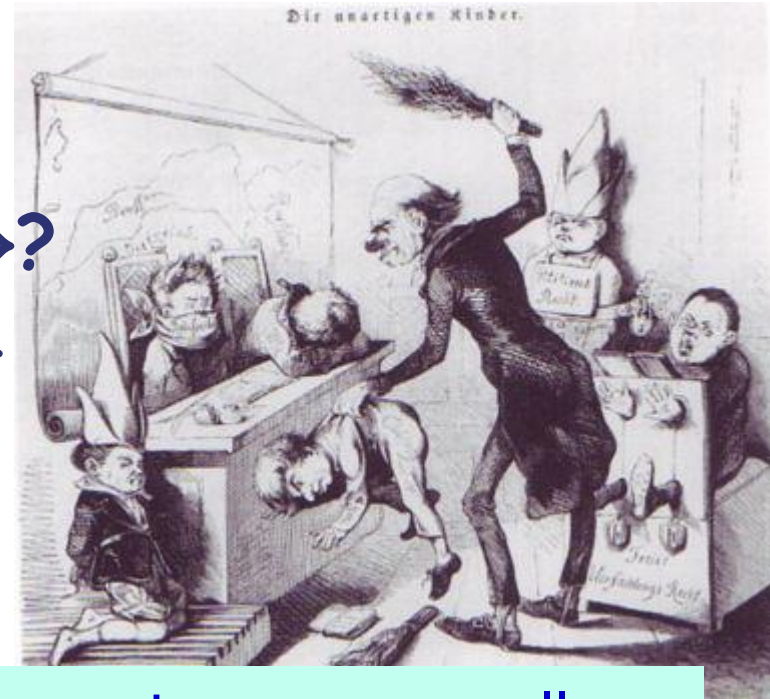
SMS benefits

- **Safety Management Systems are now a common practice and can be highly beneficial**
- **However, components must be:**
 - ❖ **Customised to fit the organisational culture and local operating environment**
 - ❖ **Actively resourced and maintained**
 - ❖ **Continually updated**
- **And the real safety management process must be consistent with the SMS!**

Myth 8

Just culture

- No blame, no punishment?
- « Errors: yes; violations: no » ?
- Who decides what is «just»?
- Why do we need a « just » culture ?
 - ❖ To compensate for a basic injustice:

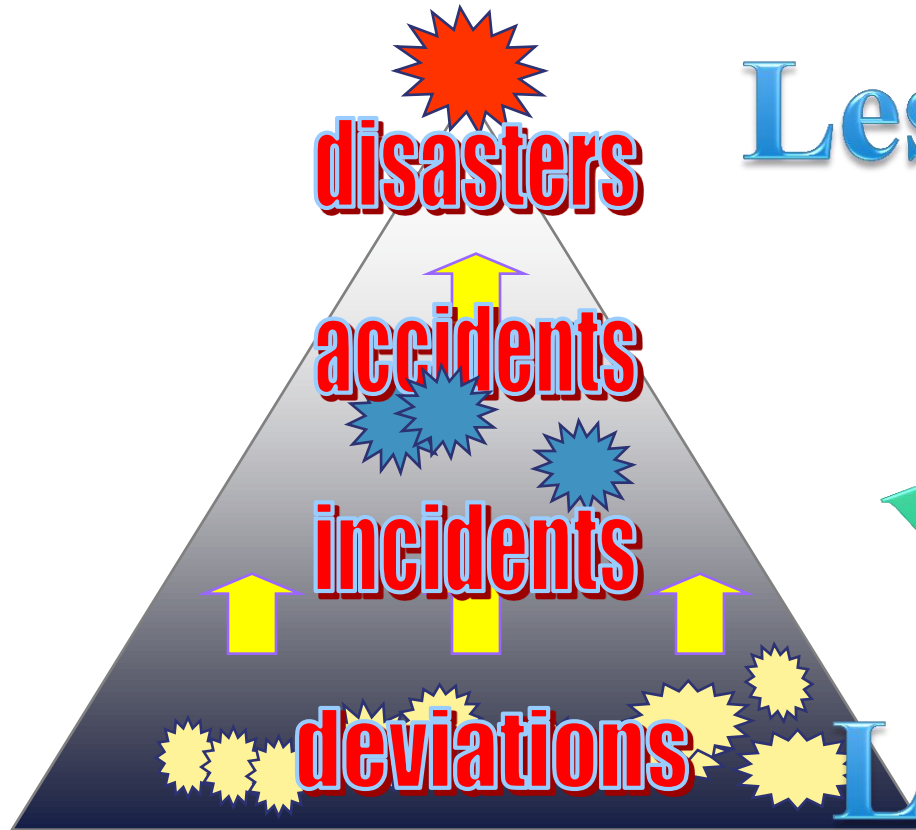


“ For the sake of safety, front line operators are usually expected to demonstrate a level of reliability that the Human-environment interaction, as designed, cannot deliver”

Pr. D. Woods

Myth 9

Less deviations, less accidents



Less accidents

WRONG

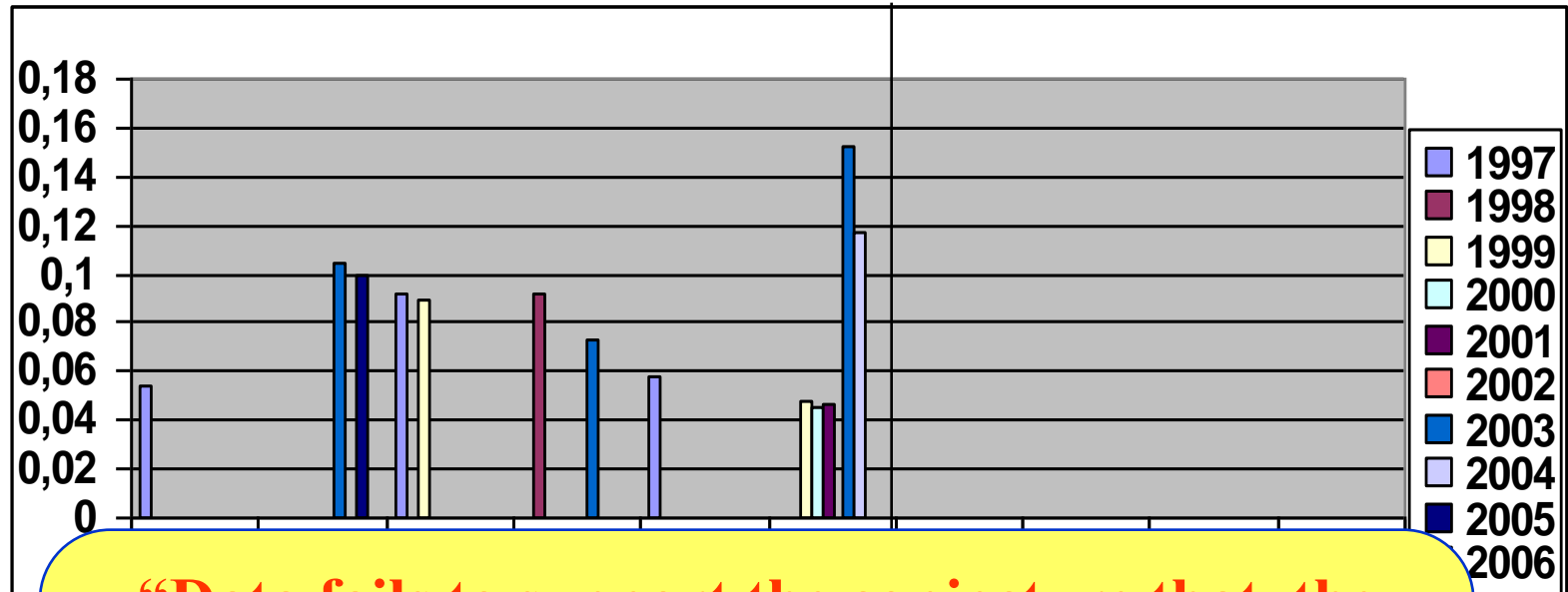
Less deviations

Bird's pyramid

US fatal accident rate /100,000 th

Majors Vs Low Cost

1997-2006



“Data fails to support the conjecture that, the greater an airline’s involvement in mishaps, the greater its propensity to suffer disasters”

Myth 10

We should and can anticipate everything what will happen



The current safety “paradigm”



- Design “reliable” and “safe” technology
- Anticipate all work situations
- Automate what can be automated
- Specify the “right” behaviour (procedures)
- Select the “right” operators profiles
- Train operators to follow procedures
- Detect and explain “errors”
- Blame the deviants (violations)
- Monitor the outcome
- Change the system accordingly

Things that have never happened before happen everyday (Scott Sagan)



The notion of « Resilience »



- Capacity of a system/organisation to maintain (at least partially) its performance in presence of variations / disruptions, including those exceeding
 - the system's design specifications (artificial system)
 - Or the system's adaptation envelope (natural system).
- Absence of resilience = brittleness

A paradigm shift:

- From : safety through conformity
- To: safety through variation management

Captain Chesley Sullenberger



- 58, 19663 flight hours
(CBS News):

- *"My initial reaction was one of disbelief. 'I can't believe this is happening. This doesn't happen to me'".*



The ironies of resilience



- The competencies needed to cope with the unexpected « in real time » are those that are lost in a continuous effort to anticipate and respond to all potential threats at the system
- Resilience implies to be prepared ... and prepared to be unprepared.

Resilience implies sub-optimal systems



- Redundancy
- Diversity
- Slack
- Stocks
- Buffers
- Flexibility
- Margins to boundaries
- ...

“Variance Reduction International, Inc. (VRI) is currently providing a competitive advantage to upstream oil operations through the deployment of Lean Six Sigma (LSS). The LSS methodology and tools make processes Safer, Better, Faster, and Lower Cost. “

Faster , Better , Cheaper , ... Safer ?



- Columbia Accident (Gheman, 2003)
- Mars Exploration Missions Accident (Stephenson 2000).
- "Both reports diagnosed a process where the pressure for production to be 'faster, better, cheaper', combined with poor feedback about eroding safety margins, led management inadvertently to accept riskier and riskier decisions »



Conclusion



- The current, dominant, safety strategy is based on the anticipation of all potential threats
- ...hence seeks reduction of all variations
- This strategy makes the system more and more reliable within its envelope of designed-for uncertainties
- ... and more and more brittle outside this envelope
- Safety management strategies should rather recognize real world complexity and unpredictability
- ... and maintain the resilience of the systems

Muito obrigado



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