“From Pyramids to Pepsi”

A look at the challenges that our industry is likely to face in the coming decades.
What if?
Resilience

Many definitions of resilience –

- Preventing further deterioration
- Strength
- Flexibility
- Toughness
- Ability to recover from something
- Respond and Change
- Ability to learn and improve
What is resilience?

“Resilience is the ability to recognise, absorb, adapt to and recover from disruptions…”

*Hollnagel, Woods & Leveson, 2006*
Resilient Pilot - The pyramid model

David Owens and Nick Dahlstrom
Great Pyramid of Giza
‘Resilient structures - the pyramid of Chichen Itza’
Resilience

- Competencies in real situations:
  - Application of Procedures
  - Communication
  - Flight path management - automation
  - Flight path management - manual
  - Leadership & teamwork
  - Problem solving & decision-making
  - Situation awareness
  - Workload management

- GOLDEN RULES FOR PILOTS

- Fly – Manual strong foundation!
- Fly – Automation also strong
- SA etc
- Task Sharing
- Communicate
- Navigate
- Monitoring

- Threats
- Errors
- Distraction
- Startle
- Fatigue
Resilience

Competencies in real situations:
- Application of Procedures
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- Knowledge
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Threats
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SA etc
Task Sharing
Communicate
Navigate
Fly – Automation also strong
Fly – Manual strong foundation!

Monitoring

Resistance

Fly – Manual strong foundation!
Resilience

Competencies in real situations:
- Application of Procedures
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- Knowledge
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Learn

SA etc

Task Sharing

Communicate

Navigate

Fly – Automation also strong

Fly – Manual strong foundation!

Monitoring

Threats
Errors
Distraction
Startle
Fatigue
What is expected – Reaction in terms of Time and Decision Making

<table>
<thead>
<tr>
<th>Time Scale</th>
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<tr>
<td>Hours</td>
<td>Rational decision making</td>
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What is expected – Reaction in terms of Time and Decision Making

- Rejected T/O
- TCAS RA
- GPWS event
- Wind shear
- Stall recognition
- Total power loss
- Autoland warning
- Loss of or no visual ref on final approach
- Brake failure
- Emergency Descent

All other decisions

Hours
- Minutes
- Seconds
- Split-second

Rational decision making
Naturalistic decision making
Conditioned Decision making
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All other decisions

Hours  Minutes  Seconds

Rational decision making  Naturalistic decision making

Split-second

Conditioned Decision making
What is expected – Reaction in terms of Time and Decision Making

1. Fly the aircraft

ENSURE THAT THE AIRCRAFT IS STABILISED ON A SAFE TRAJECTORY AT A SAFE ENERGY LEVEL

ONLY THEN

2. THINK

3. Communicate

4. Decide

5. React

MUST REACT IMMEDIATELY and CORRECTLY (Reflex or memory)

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1. Fly the aircraft

MUST REACT IMMEDIATELY and CORRECTLY (Reflex or memory)
What is resilience?

“Resilience is the ability to, recognise, adapt, recover and learn from unusual or exceptional events”

(so as to be able to sustain an operational and safe state, now and in the future)

*Hollnagel, Woods & Leveson, 2006*
Pyramids - Resilient structures
Paradox of resilience

Avoid cascading systemic failures

Resistance

Return quickly to a “normal” functional state

Adaptation

Minimise any disruption
recover and learn

Adherence to procedures
Checklist disciplines
Training
Control of “system1” behaviour
Application of those competencies

Assimilation of situation
Knowledge
Workload capacity
Flexible response
Use of best information

We need to resolve this paradox
People - and Resilience

Individual professionals

Aircraft

Airlines

Industry

is an

Individual professionals

Individual professionals

Individual professionals
People - and Resilience

Individual professionals in one industry

Resilience is about people - it’s a people “thing”
People --- Courage needed to make significant progress

Bernard Zeigler

Jacques Rosay

Gustav Whitehead

Isambard Kingdom Brunel

Load factor 2.5 g
Bank angle 67° Bank
High speed Vmo / Mmo + Margin
Ground mode
Flight mode
Flare mode
Ground mode

Pitch limits +30° / -15°

High AOA

AIR FLOW

α
Changing social scene

Are we seeking the fatal flaw in these changing behaviours—

Attitude to risk

“Celebrity culture”

Service “sucks”

Trial by media

Trust in software

What home telephone?

“My rights” not “my responsibilities”
The “Sir Charles Hadden-Cave QC” report to the House of Commons on the Nimrod accident in Afghanistan made responsibilities very clear. It was entitled:

“A FAILURE OF LEADERSHIP, CULTURE AND PRIORITIES”

He named and shamed 10 senior individuals who in his view carried direct and indirect responsibility for the accident

e.g. Mr Haddon-Cave criticised a General ---- “He should have realised it could come at the expense of safety and airworthiness”,

e.g. Mr Haddon-Cave accused a Group Captain of a "fundamental failure of leadership" in drawing up the "safety case" into potential dangers in the fleet.
Safety Culture - The role of leadership

From his first day he focused on 1 policy

Worker Safety

He made Safety the No 1 item on every managers agenda

He demanded notification of every incident within 24 hrs

He took personal responsibility for all injuries to his people

“to disrupt a habit”

He prioritised Safety and used data to achieve his objective

Paul O’Neil
CEO of ALCOA
1987 to 2000
Safety Culture - The role of leadership

In his view, his greatest achievement was to leave a resilient legacy of safety

A safety minded culture.
Safety Culture - The role of leadership

He has three questions for people in organisations that aspire to greatness:

1. “Are you treated with dignity and respect by everyone you encounter?”

2. “Are you given the things you need, so that you can make a contribution that brings meaning to your life?”

3. “Do you get recognised for what you do?”

“Greatness” implies a truly resilient organisation
Cynthia Carroll

CEO of Anglo- American 2007 - 2013

Nearly 200 deaths in 5 years
She unilaterally closed the worst mine
5000 miners were brought to the surface
Re-trained 30,000 workers

Working with the government and the workers unions, she set a new standard for mining safety in South Africa

By 2011 the death rates in Anglo American had dropped by 62% and the wider industry rates had dropped by 25%

Her goal – zero harm to every worker

She prioritised Safety and used data to achieve her objective
People - Small signals, big results
Data - making use of data as a “value chain”

- **Data**
  - is just data
  - e.g. Radio sonde digital weather info

- **Information**
  - is data in a usable form
  - e.g. An updated weather forecast

- **Knowledge**
  - is information in a context
  - e.g. What impact that forecast has in an operational sense

- **Wisdom**
  - is the application of that knowledge modified by experience
  - e.g. “We need to divert now”

We have to capture and share data, information, knowledge and experience.

How successful we are at capitalising on its value will be a major factor in preventing the fatal flaw.
Resilience is about:

- **People:** Leadership : Culture : Ownership : Commitment
- **Process:** Avoidance : Stabilisation : Recovery : Learning

- **Data - Information – Knowledge - Wisdom**
- **Sharing and communication**

As we get better, the challenge will become more severe
Data - The imperative to learn from Best Practice

Use data to learn from positive behaviours and events

(Heinrich, 1931; Hollnagel, 2014)
Gaining a broader view
Let’s look at the build up to Eyjafjallajokull
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1982 BA9
4 engine failure due to ingestion of volcanic ash
Indonesia

1989 KLM 867
4 engine failure due to ingestion of volcanic ash
Alaska

Engine efficiency
Greater “sensitivity” to ingested substances
Various locations

Volcanic activity monitoring

New ash dispersion model
UK

Eruption

1982  2010
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“We are Scientists”

I suspect that there will be more issues of this sort in the future
One industry, one set of objectives?

Harmonised solutions

Longer term plans

“Balance” of pace

Wider industry needs must “trump” local issues

Maximise learning opportunities

Establish a globally accepted “just culture”

The industry must progressively work towards one set of agreed safety objectives
One industry, one set of objectives?

Tear the walls down
Growth and Capacity

Yearly fatal accident rate per million flights
Growth and capacity

Getting it wrong

Getting it right?
Or wrong!
Growth and Capacity - An example - Multiple diversions

The experienced pilots “go” early and it’s happening today

Ad Lib (or “every man for himself”)

PLAN A

Destination

PLAN B

Diversion
Capacity is also being consumed by “efficiency” policies

But is safety contingency capacity fully considered and regulated?
So where will we find that fatal flaw?

- Not having one set of agreed global safety objectives
- Failing to secure industry wide resilience through “people focused” safety culture change
- Failing to handle data in a consistent industry wide manner
- Inability to manage growth versus capacity properly
- Driving for “efficiency” without safety contingency
- Not taking into account those changing social attributes
- Having too narrow a view
- Not taking seriously the security threat – now!
The need for a “balanced” approach

PAST
Learning from

FUTURE
Preparing for

SIMPLE
Low Hanging Fruit

COMPLEX
Challenging

ACCIDENT INVESTIGATION
New barriers

DATA MINING
New solutions

TECHNOLOGY
Optimise strengths

HUMAN
Capitalise on Adaptability

GROWTH
Natural

CAPACITY
Safety Contingency
To minimise the risk associated with that fatal flaw

• Beware the “innocence” of software
• Capitalise on human adaptability
• Emphasise the value of “listening”, really listening
• Make learning and particularly teaching “cool”
• Make progress through small ideas or many small steps
• Develop our leadership skills
• Develop “first and second follower” skills
• Move towards “we”, not “me” thinking
• Develop “groups” inside airline rostering systems – build teams
• Achieve balance
Paul O’Neil also said …

“We are not going to budget safety”

and finally

“Safety should never be a priority –
  it should be a pre-condition ……
  ……It’s like breathing”
“Mens agitat molum”

Thank you for listening to me