Continuous Change and Added Complexity – A Real Threat to Safety?

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Every time there is a change to rules or procedures in aviation it adds a layer of complexity for the operators.

Some of this complexity is temporary – some is permanent.
Infusion pumps are devices that control the flow of medication or other product into a patient through an intravenous (IV) line.

An infusion pump manufactured by Alaris Products and used in many hospitals had a “key bounce” problem such that pressing a button once would sometimes register that keypress twice. For example, pressing 4.8 might result in “44.8” being entered, which represents a 10-time overdose.

In August, 2006, the manufacturer was ordered by the US Food and Drug Administration (FDA) to send a letter to every hospital still using their device. The letter alerted hospitals to the problem and offered these solutions:

(1) provide instructions for nurses to use a proper stance  
(2) listen to the number of keypress beeps  
(3) verify the screen display  
(4) obtain an independent double check  
(5) look at the IV tubing to verify the correct flow rate; and  
(6) a warning label should be placed on each device.

A simpler and more effective solution might have been to fix the mechanical key bounce problem. (Holden, 2009)
Who Moved My Cheese?
Drivers of Change

International Bodies
Regulators
Manufacturers
Air Traffic Service Providers
Airport Companies
Engineering
Company/Flight Operations Management
Safety Departments
Resistance to Change (RTC)

- Well established phenomenon
- Varies widely
Reasons for Resistance

- Organisational Goal to Change to New Procedure
- Individual Inertia to Maintain Status Quo
  - Too Complex – Requires Considerable Cognitive Effort
  - Too Many Changes – Change Fatigue
  - Lack of Perceived Need or Relevance
  - Individually Low Tolerance to Change
  - Lethargy, Complacency, Stubbornness
Incongruous Change Adoption

- Initial State
- Knowledge State
- Change Implementation date
- Required State, Post-Change
- Time
- Early Adopters
Incongruous Change Adoption

- Early Adopters
- Moderate Adopters

Change Implementation date

Required State, Post-Change

Opportunity for procedural incongruity

Knowledge State
Initial State

Time

Early Adopters
Moderate Adopters
Incongruous Change Adoption

- Early Adopters
- Moderate Adopters
- Late Adopters

Opportunity for procedural incongruity (May be longer for complex changes)
Threat and Error Management

Relies on two main tools:

1. An established framework of procedures and routines which creates both an individual and team mental model of what should happen.

2. Individual and Team Resilience, utilising CRM skills to detect, mitigate and manage unexpected issues.
Aviation Change and Complexity Survey

• Online survey conducted in July/August 2015

• 15 Multi-choice questions plus an opportunity for open comment

• Disseminated to Pilot Associations for mail-out to members

• 776 Survey Responses
  - 125 Long Haul
  - 651 Short Haul
Aviation Change and Complexity Survey

Aviation procedures and regulations involved in flying the aircraft from point A to point B have become more complex over the past five years

- **Strongly agree**: [Bar chart showing significant data]
- **Agree**: [Bar chart showing significant data]
- **Neither agree nor disagree**: [Bar chart showing significant data]
- **Disagree**: [Bar chart showing significant data]
- **Strongly disagree**: [Bar chart showing significant data]

Overall:
- 689 Pilots Agree
- 28 Pilots Disagree

Highly significant p<0.01
The evolution of aviation procedures and regulations in recent years has improved aviation safety

Overall:
181 Pilots Agree
307 Pilots Disagree

Highly significant p<0.01
Aviation Change and Complexity Survey

Understand the rationale behind a new or revised aviation procedure or regulation

<table>
<thead>
<tr>
<th>Response</th>
<th>Number of Pilots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>5</td>
</tr>
<tr>
<td>Agree</td>
<td>4</td>
</tr>
<tr>
<td>Neither agree nor disagree</td>
<td>3</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
</tr>
</tbody>
</table>

Overall: 64 Pilots Agree, 584 Pilots Disagree

Highly significant p<0.01
Aviation Change and Complexity Survey

It is easy to locate specific information and reference material with respect to aviation procedures and regulation changes

- Strongly agree: 5
- Agree: 4
- Neither agree nor disagree: 3
- Disagree: 2
- Strongly disagree: 1

Overall:
- 43 Pilots Agree
- 646 Pilots Disagree

Highly significant p<0.01
New or revised aviation procedures and regulations are written in a way that is easily understood so that their interpretation is consistent between crew members.

Overall:
31 Pilots Agree
651 Pilots Disagree

Highly significant p<0.01
Aviation Change and Complexity Survey

External distractions during flight safety critical tasks (such as during take-off performance calculations) are minimal due to well trained and disciplined support agencies.

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Overall:
167 Pilots Agree
414 Pilots Disagree

Highly significant p<0.01
Pilots have sufficient time during their pre-flight duties to mentally prepare for the flight ahead without any distractions

Overall:
189 Pilots Agree
450 Pilots Disagree

Highly significant p<0.01
Aviation Change and Complexity Survey

Changes or revisions to regulations are clearly communicated and adequately distributed

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Overall:
- 85 Pilots Agree
- 518 Pilots Disagree

Highly significant p<0.01
Aviation procedures and regulations are risk managed appropriately, prior to implementation

Overall:
58 Pilots Agree
497 Pilots Disagree

Highly significant p<0.01
Regulations and procedures introduced in recent years have simplified the job

- Strongly agree: 5
- Agree: 4
- Neither agree nor disagree: 3
- Disagree: 2
- Strongly disagree: 1

Overall:
- 19 Pilots Agree
- 681 Pilots Disagree

Highly significant p<0.01
Aviation Change and Complexity Survey

Changes to regulations and aviation procedures occur too frequently

- **Strongly agree**: 5
- **Agree**: 4
- **Neither agree nor disagree**: 3
- **Disagree**: 2
- **Strongly disagree**: 1

Overall:
- **630 Pilots Agree**
- **39 Pilots Disagree**

Highly significant $p<0.01$
Aviation Change and Complexity Survey

Typical Comments From Optional Open Comments Question (n=218)

‘On a company level, procedures and policies are added and changed so frequently that the risk of misinterpretation of information may affect the safety of the operation....’

‘Most changes are made in good faith with safety in mind, however if there are too many changes, pilots will revert to what they have done in the past...’

‘I regularly see unnecessary layers of artificial complexity consume a large portion of Pilot’s mental capacity and blind or distract them from the simplest tasks on a day to day basis where a simple and pragmatic approach would suffice....’

‘The multiple changes in Reg’s, compliance, SOP's and a constant production of operational notices have made my job as a Captain just unbelievably difficult...’
Questions?