"What are you sinking about?"

Stéphane De Wolf
30 bn$/year

Sources: Flight Safety Foundation, IATA
AIRLINE INDUSTRY

Primary factors in aircraft accidents:

- **49%** - Pilot Flying (PF) adherence to procedures
- **45%** - other procedural consideration
- **31%** - Pilot Monitoring (PM) adherence to procedures
- **28%** - embedded piloting skills
- **24%** - design improvement
- **19%** - Captain's or instructor's exercise of authority
- **17%** - maintenance or inspection action

Source: Flight Safety Foundation
Causal factors in business jet fatal accidents:

- **42%** - *procedural* issue (omission, inappropriate action)
- **37%** - flight handling
- **29%** - lack of positional awareness
- **27%** - poor professional judgement/airmanship
- **19%** - failure in CRM (cross-checks, coordination)

Source: UK CAA - Business Jet Safety research report
"Change everything but the driver..."
Too many procedures
Inappropriate procedures
Operational learning
TOO MANY PROCEDURES

(overproceduralization)
WRITING ANOTHER PROCEDURE...

Actions sometimes necessary to get the job done

Scope of actions allowed

Continuous updating of procedures to avoid recurrence of past accidents and incidents

Impossibility to get the job done without violating the rules and procedures

Source: Maurino, Reason, Johnston & Lee
INAPPROPRIATE PROCEDURES
60% of human factor-related incidents in U.S. nuclear power plants are due to an incorrect procedure.

Source: U.S. Institute of Nuclear Power Operations
Analysis of incidents in the Dutch chemical industry:

- **28%** - the (correct) procedure was not followed
- **12%** - the procedure was wrong
- **10%** - no or unclear procedures

Source: Dutch Labour Inspectorate
BIZJETS ACCIDENTS
(1991 - 2010)

N°1 TYPE: loss of control

- 71 accidents
- 18% takeoff
- 48% approach and landing

altitude

- 63% below 1.000 ft
- 1.000' - 10.000'
- ≥ 30.000'
- unknown altitude

factors

- intentional
- windshear
- flight controls
- automation

- 43% unintentional stall
- 45 accidents
- 34 accidents
- 31 accidents

Source: P. Veillette
BIZJETS ACCIDENTS
(1991 - 2010)

Unintentional stalls (43%)
31 accidents

42% takeoff
13 accidents

- improper weight & balance
- inadequate acceleration
- over-rotation
- incorrect takeoff speeds
- locked parking brake
- contamination (ice, frost, etc.)

Source: P. Veillette
BIZJETS ACCIDENTS
(1991 - 2010)

- Unintentional stalls (43%)
- 31 accidents
- 42% takeoff
- 13 accidents

- 58% approach and landing
- 18 accidents

- Improper weight & balance
- Inadequate acceleration
- Over-rotation
- Incorrect takeoff speeds
- Locked parking brake
- Contamination (ice, frost, etc.)

- Inadequate monitoring/cross-checking
- Abnormal circling approaches
- Icing (especially with de-ice boots)

Source: P. Veillette
"Each additional item that is added to a checklist increases the potential for:

• **interruptions** when accomplishing it;
• **diversion** of the crew's attention at a critical point;
• **missing** critical items."

...and for crews to cut corners, omit items or even ignore the checklist entirely.

Sources: FAA Air Transportation Ops Inspector’s Handbook, FAA HF Considerations in the Use and Design of Aircraft Checklists
OPERATIONAL LEARNING
OPERATIONAL LEARNING

Work as imagined, planned

Work as done

Real error margin

Danger

Operational learning

Source: T. Conklin, Los Alamos National Laboratory
What happened the way you thought it would happen?

Source: T. Conklin, Los Alamos National Laboratory
What surprised you?

Source: T. Conklin, Los Alamos National Laboratory
What hazards did we identify?
What hazards did we miss?

Source: T. Conklin, Los Alamos National Laboratory
Where did you have to improvise and adapt?

Source: T. Conklin, Los Alamos National Laboratory
Highly recommended articles and books...

- Veillette. 2012. *Investigating and preventing the loss of control accident*. ISASI Forum