

# AVIATION LESSONS

## for TRAM OPERATIONS

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Photo credit: Channel 3 News, Memphis



Photo credit: Sharad Ranabhat

2005 - 2007

Air Ambulance in Northern Canada



# 2007 - 2016

## Air Canada Express



Photo credit: Skies Magazine



# 2008 & 2011

## Accident investigation training



# AIR SAFETY VOLUNTEER WORK

International Society  
of Air Safety Investigators

[www.isasi.org](http://www.isasi.org)

Honourable Company  
of Air Pilots (pilots' guild)

[www.airpilots.org](http://www.airpilots.org)



NEW ZEALAND SOCIETY  
OF AIR SAFETY INVESTIGATORS



THE HONOURABLE COMPANY OF  
AIR PILOTS

# TODAY'S DISCUSSION

## AVIATION LESSONS THAT CAN BE APPLIED TO TRAM OPERATIONS

### 1. Emergency checklists

✈ Possibly best piece of emergency equipment

### 2. Passenger evacuations

✈ Rise of undesirable behaviour

# WHAT IS THE MOST IMPORTANT ITEM IN AN EMERGENCY FOR PLANES/BOATS/TRAMS?

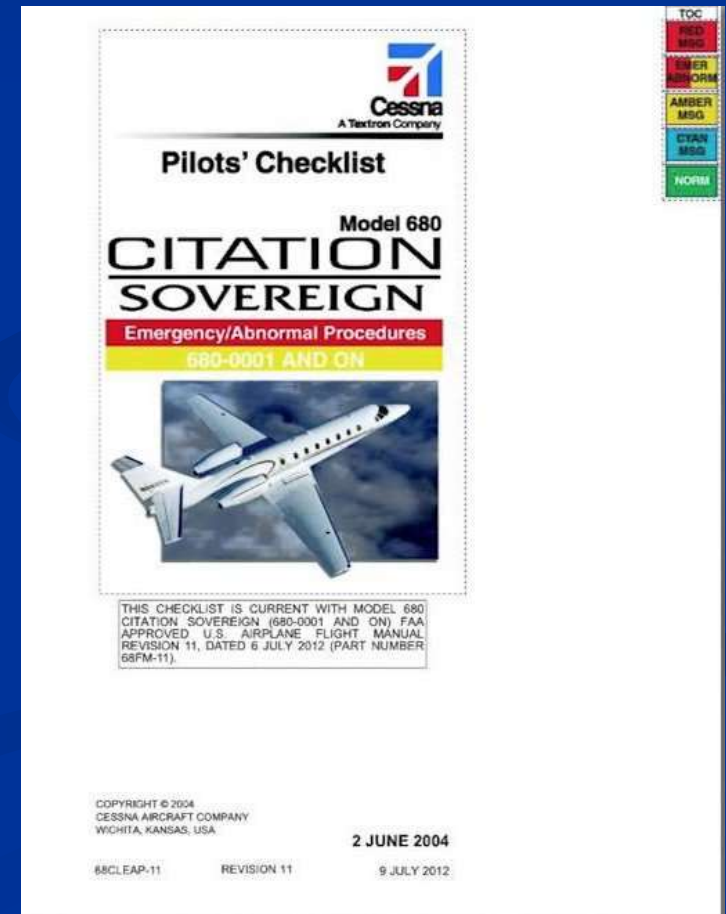
- ➔ Fire extinguisher?
- ➔ First Aid Kit?
- ➔ Defibrilator?
- ➔ Emergency Brake?
- ➔ Emergency Exit?

# WHAT IS THE MOST IMPORTANT ITEM IN AN EMERGENCY FOR PLANES/BOATS/TRAMS?

✈ Emergency checklist book!

✈ Why?

✈ Psychological phenomenon called **STARTLE EFFECT**





# STARTLE EFFECT

- ➔ Defined by USA FAA as:
  - ➔ *“uncontrollable, automatic reflex that is elicited by exposure to a sudden, intense event that violates a pilot’s expectations.”*
- ➔ Basically, the Fight or Flight reflex
- ➔ Physical response is automatic & instantaneous
- ➔ Mental response much slower

# PHYSICAL RESPONSE TO STARTLE EFFECT

- ➔ Signal sent to both emotional and rational parts of brain
- ➔ Emotional part of brain responds first
- ➔ Triggers adrenalin shot
- ➔ Takes over (hijacks) rational brain function

# MENTAL RESPONSE TO STARTLE EFFECT

- ➔ Basic motor response disrupted for 3 seconds
- ➔ Complex motor tasks disrupted for 10 seconds
- ➔ Information processing disrupted for 30-60 seconds
- ➔ Overall cognitive processing disrupted, leading to poor decisions / inappropriate actions for the situation

**ANTIDOTE IS A WELL-WRITTEN  
EMERGENCY CHECKLIST**

# EMERGENCY CHECKLISTS

## BASICS

- Following an emergency, brain function is compromised
  - Teach crew to go to checklist promptly to restore some rational thought
- Well-written checklist can help diagnose ambiguous situations
  - Systems can be complex, particularly electrical

# POORLY WRITTEN CHECKLIST

## SWISSAIR FLIGHT 111:

- Lost with all souls in 1998
- Pilots followed checklist directly into a crash
  - Smoke inhalation not given serious enough consideration
  - Aircraft manufacturers amended their checklists worldwide



Photo credit: Alchetron

# CHECKLIST NOT FOLLOWED

## AIR TRANSAT 236:

- ➔ Ran out of fuel halfway across Atlantic in 2001
- ➔ Safely glided to Azores Islands
  - ➔ No fatalities
- ➔ Pilots failed to follow checklist which would have alerted them NOT to transfer fuel if a leak was suspected



Photo credit: CBC



Photo credit: Sharad Ranabhat

# WHY IS THE POLE STILL ON THE WIRE? STARTLE EFFECT? POOR CHECKLIST?



Photo credit: Channel 3 News, Memphis



Photo credit: Jessica M. Hackett

# EMERGENCY CHECKLISTS

## SUMMARY OF MAIN POINTS

1. Teach crews to go to checklist promptly in emergency
  - Immediate/memory items may take precedence
2. Review them following serious incident
  - Swissair 111 led to many changes
3. Make sure it's actually onboard
  - Dash 8 aircraft flew 80+ times with wrong checklist



# PASSENGER EVACUATIONS

- ➔ Last item on checklist might be an evacuation
  - ➔ Being at the end gives false impression emergency has been fully dealt with
- ➔ In reality, evacuations are chaotic affairs
  - ➔ People taking baggage
  - ➔ People taking video dangerously close to hazards
- ➔ Remedy is rehearsal / practice

# WHY EVACUATE?

## SMOKE INHALATION

- In a fire situation, more likely to be killed by smoke than burns
- Fire sucks in  $O_2$  reducing amount available for breathing
  - Using  $O_2$  mask helps but takes a long time to bring someone back to normal

# SMOKE INHALATION

- High temperature of inhaled smoke inflames airways & lungs, blocking oxygen supply and makes breathing difficult
- Gas from smoke contains CO and cyanide
  - Bonds to blood molecules easier than O<sub>2</sub>, blocking supply of O<sub>2</sub> to brain / other organs

**ANTIDOTE IS TO GET  
PEOPLE AWAY FROM IT**

# PROBLEMATIC EVACUATIONS

## AIR FRANCE FLT. 358:

- Half the exits did not open
- Several passengers took their baggage, despite seeing flames (not just smoke)
- Somehow, no fatalities
- Captain was worst injured
  - Conductors may have to command evacuation if Motorman incapacitated



Photo credit: Sharad Ranabhat

# PROBLEMATIC EVACUATIONS

## BRITISH AIRWAYS 2276:

- ➔ Uncontained engine fire during takeoff roll
- ➔ Several people filming, competing to get best video
- ➔ Several people exiting with their baggage, despite visible flames near fuel tanks holding enough fuel to fly for 10+ hours



Photo credit: Stephan Lanfermeijer

# PROBLEMATIC EVACUATIONS

## AEROFLOT FLIGHT 1492:

- ➔ Hard landing resulting in the landing gear collapsing
- ➔ Occupants in the front of the aircraft got out with their baggage while 41 passengers died in the back

Photo credit: Stephan Lanfermeijer



Photo credit: Ernest Arvai

# PROBLEMATIC EVACUATIONS

## DASH 8 vs. FUEL TRUCK:

- Late night collision due poor visibility in snow
- Passengers evacuated before command given
  - Propellers still turning
- Captain injured, same as for Air France
  - Conductors may have to command evacuation if Motorman incapacitated



Photo credit: TSBC

# PASSENGER EVACUATIONS

## SUMMARY OF MAIN POINTS

1. Practice
2. Practice
3. Practice



# PASSENGER EVACUATIONS

## SUMMARY OF MAIN POINTS

- ➔ Where possible, use actual equipment
  - ➔ E.g. Qantas training facility in Sydney
- ➔ Simulate door failure(s)
- ➔ Put prams / pushchairs in the way
- ➔ Passengers with limited mobility

# FINAL THOUGHTS

- Examples shown have been extreme in comparison to normal tram operations
  - Trams do not have temp. gauge for resistance grid
- Checklist most important emergency eqpt.
  - Review after incident and amend if necessary
- Evacuations going to be chaotic
  - Practice, practice, practice!

# QUESTIONS?

