Session 8

Case Study

SEMINAR ON AIRCRAFT ACCIDENT INCIDENT INVESTIGATION
11-15 AUGUST 2014
Case Study

- Takeoff From Shortened Runway
- B777 Turbulence Investigation
- Wing Clipped of Two B777s
- Runway Incursion by maintenance vehicle
Takeoff from Shortened Runway
Takeoff From Shortened Runway
Details of shortened runway
1st Incident on taking off from shortened runway

- 30 MAY 2007 – Airbus A340 took off without knowledge of shortened runway

- PIC reacted on seeing alternating centreline lights and applied TOGA to lift off

- Did not report to ATC, Air Safety report was submitted. CAAS and AAIB informed by CAA of airline
2\textsuperscript{nd} Incident on taking off from shortened runway

- 2 June 2007 – Boeing B747-300 took off with full knowledge of the shortened runway
- AAIB was not informed of the occurrence
- Found out from the ATC abnormal report
- Occurrence site was cleaned up
On receiving the information...

- What would you do next?
- What info will you seek?
  - Type of aircraft
  - Passenger number
  - Any fatality or injury
  - Aircraft damage and other property damage?
  - Terrain of crash site
- What evidence would you want to secure?
- What else????
# Information collection

<table>
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<tbody>
<tr>
<td>1</td>
<td>Flight operation details (Interview)</td>
<td>Pilots</td>
<td></td>
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<tr>
<td>2</td>
<td>Pre-flight briefing and info</td>
<td>Despatcher</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Air traffic control (Interview)</td>
<td>ATCO</td>
<td></td>
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<tr>
<td>4</td>
<td>Ground witnesses</td>
<td>Aerodrome operator</td>
<td></td>
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<tr>
<td>5</td>
<td>ATC recording (Voice and ground radar)</td>
<td>ATC Operator</td>
<td></td>
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<td>6</td>
<td>Flight document, notams, performance charts</td>
<td>Airline</td>
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<tr>
<td>7</td>
<td>Aerodrome Safety Assessment</td>
<td>Aerodrome operator</td>
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</table>
Flight crew took off without knowledge that runway was shortened

- Airline’s NOTAM processing system did not pick up Changi NOTAM A1045/07
- Despatcher briefing crew stated that the crew was informed of the shortened runway and an extract of the AIP Supplement was provided
- Crew stated that no information on the shortened runway was provided by the despatcher
- Extract not found among the document submitted after the flight
Flight crew took off without knowledge that runway was shortened (cont’d)

- Crew did not return to listen for any update in ATIS information even though they were aware that ATIS will be updated every half an hour.
- ATCO did not positively challenge the flight crew when crew reported an outdate ATIS identifier when requesting for clearance.
- F/O stated will check the ATIS again but forgot to do so subsequently (cited momentary workload increase and short taxi).
Flight crew took off without knowledge that runway was shortened (cont’d)

- ATCO after checking that ATIS was actually updated, assumed that flight crew will check ATIS did not check back with crew to ensure that they had obtain the update ATIS
- Flight crew did not see 2 guidance signs enroute to the runway that indicated the length of shortened runway and the “Shortened Runway” sign positioned across the runway
Runway 20C and Signs

- Shortened Runway
- E1 Taxiway
- Aircraft moving from holding pt to line up with runway 20
- Lighted sign facing E1 entry taxiway showing "SHORTENED RUNWAY"
- Lighted sign at E1 holding position showing "2500m"
Swiss Cheese Model
Changi NOTAM A1045/07

Information not pick up during despatcher briefing

Flight crew did not recheck ATIS before seeking clearance

Lack of positive challenge from ATCO when Flight crew reported an outdated ATIS letter identifier

F/O did not recheck ATIS even though stated that he will check ATCO also did not check back to ensure that flight crew obtained the updated

Flight crew did not see runway shortened Info on sign boards enroute taxi to runway

Pilot’s action (Intervention) prevented possible catastrophe
Safety Recommendations

Airport operator to:
- review if guidance signs in airport can be improved to increase its effectiveness in drawing flight crews’ attention (sign board used meet ICAO Annex 14 requirement)

Airline operator to:
- Review procedure and training of the pilots to improve their awareness of guidance signs around airports
- Require pilots to report any significant incident which they are aware of to the local air traffic control unit
Damage caused by 2nd Incident

Marker boards damaged by Landing Gear (possibly) and jet blast
2nd Incident on taking off from shortened runway

- Performance charts provided to flight crew different from what they were familiar with
- FO used a wrong column of data (meant for full runway length) to compute the take-off performance limit for the shortened length
- Operation procedure did not require flight crew to carry out independent check of critical computation
Safety Recommendations

To the operator to:

- ensure that flight crews are briefed before implementing changes to performance charts/document used for flight planning
- ensure that computation of critical data by flight crews is cross-checked to eliminate error
B777 Turbulence Investigation
B777-200 departed Singapore for Nagoya, Japan on 28 Jun 04
Flight encountered moderate turbulence en-route
A cabin crew was reported to have sustained injury
What would you do?

What info would you need?
- Location of aircraft when it happen
- Aircraft type
- Number of injured (detail of injury sustained)

What evidence would you collect?
- FDR/CVR
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<td>Flight operation details (Interview)</td>
<td>Pilots</td>
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<tr>
<td>2</td>
<td>Cabin crew (Interview)</td>
<td>Cabin Crew</td>
<td></td>
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<tr>
<td>3</td>
<td>Passenger (Interview)</td>
<td>Passengers</td>
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<tr>
<td>4</td>
<td>Medical report of injured (Cabin Crew, Passengers)</td>
<td>Operator/hospital</td>
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<tr>
<td>5</td>
<td>Quarantine FDR/CVR</td>
<td>Operator</td>
<td></td>
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<tr>
<td>6</td>
<td>Operator’s flight crew operation manual and Safety Emergency manual</td>
<td>Airline</td>
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<td>7</td>
<td>???</td>
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Sequence of Events

- Weather forecast indicated that weather enroute would be rough for 1\textsuperscript{st} four hours of flight
- Cabin crew were briefed of the weather situation
- Seat belt sign was left on after meal service as it was a over-night flight
- Before the sudden on-set of turbulence, flight crew cycled fasten seat belt (FSB) switch in an attempt to sit the cabin crew
Sequence of Events

- Cabin crew only heard one chime and went on with normal routine to check cabin
- When aircraft hit turbulence, one cabin crew at aft was flunk to the ceiling and landed on both wrist
- The crew suffered fracture of both wrist and cuts on forehead
- Based on the extend of injury, the occurrence was classified as an accident
Operator’s SOP

- If turbulence warrants suspension of cabin services, flight crew shall advise cabin crew.
- For sudden on-set of turbulence and no time to advise cabin crew, flight crew are required to put FSB switch from OFF/AUTO to ON and OFF and ON again.
Cabin Crew’s Interpretation of FSB Chime Signal

- Single chime
  - Impending light turbulence or just a precautionary measure, no need to be seated immediately

- Multiple chimes
  - Impending moderate to severe turbulence, need to suspend cabin services and need to be seated

It seems that the flight crew did the correct action of cycling the FSB switch in an attempt to generate multiple chimes at the impending turbulence to sit the cabin crew.
What happened in the cabin??

- All the four cabin crew interviewed testified that only one chime heard in the cabin
- Crew went on to carry out the set of actions required for light turbulence:
  - Visually check all pax fastened sea belt
  - Monitor pax in toilets
  - Ensure infants are removed from their bassinets
  - Ensure all galley equipment stowed and secured
Findings on FSB switch

- Investigators found out that the FSB switch would not produce multiple chimes when it is cycled too fast from OFF/AUTO to ON and OFF and ON again on one of the aircraft.
- Similar finding on simulator

  Flight crew could have operated the FSB switch too quickly which resulted in only a single chime generated in the cabin.
Lessons Learnt

- The system of using the number of chimes to inform cabin crew to cease service is not robust as the no. of chimes produced depends on how fast the FSB switch is being operated.

- Aircraft manufacturer did not endorse the use of chime signal to inform cabin crew of impending turbulence.
Wing Clipped of Two B777
Synopsis

- Aircraft A was taxing along taxiway C1 while aircraft B was pushing back from gate F37, both aircraft were departing.
- Flight crew of aircraft A stopped the aircraft and checked with ground controller when they found that aircraft B was close.
- Crew of aircraft A was told to taxi past aircraft B if they deemed enough clearance.
- Crew of aircraft A thought they had sufficient clearance and continued with moving and resulted in wing tip collision.
Taxi and pushback route
Damages

**Aircraft A**

Top of left wing area

**Aircraft B**

Right wing tip and aileron
What information would you be looking for?
What evidence would you collect?
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<td>FDR and CVR of both aircraft</td>
<td>Airline/s</td>
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<tr>
<td>2</td>
<td>Pilots of both aircraft (Interview)</td>
<td>Airline/s</td>
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<tr>
<td>3</td>
<td>Headset man (Interview)</td>
<td>ATC Operator</td>
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<td>4</td>
<td>ATC recording (Voice and ground radar)</td>
<td>ATC Operator</td>
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<tr>
<td>5</td>
<td>Aerodrome charts and flight crew operating manual</td>
<td>Airline</td>
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<tr>
<td>6</td>
<td>Collect aircraft debris / parts</td>
<td>Aerodrome Operator</td>
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<tr>
<td>7</td>
<td>Reviewing of ATC and aerodrome procedure</td>
<td>Aerodrome Operator/ATC Operator</td>
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Aerodrome and ATC 1/2

- Parking gate F37 was previously designated for smaller aircraft due to limited equipment staging area (ESA)
- Was upgraded to accommodate B777 aircraft after boundary line for ESA redrawn
- NOTAM was issued 10 days before the occurrence to announce the use of F37 for B777
- ATSM for pushing back from F37 highlighted that during pushback from F37, aircraft is not clear of taxiway C1.
Aerodrome and ATC (2/2)

- ATC normally assign aircraft on taxiway C6 to taxi via C3 when aircraft is pushing back.
- On the day of incident, taxiway C3 was closed for maintenance.
- ATSM pushback procedures only available to ATCOs and Ground Controller was aware of the clearance limitation on taxiway C1 when aircraft pushback from F37.
- Clearance provided by Ground Controller to aircraft A was a conditional clearance and is an accepted practice.
Right of Way On Ground

Para 33(2) of the Eleventh Schedule of the ANO:

“Not withstanding any air traffic control clearance –

(a) the pilot in command of a taxiing aircraft shall ensure that the aircraft does not collide with any other aircraft or with any vehicle or obstacle while the aircraft is taxiing; and

(b) the leader of the towing crew shall ensure that the aircraft does not collide with any other aircraft or with any vehicle or obstacle while the aircraft is being towed
Technique for Wingtip Clearance (1/2)

- PIC employed a technique consisted of determining whether the wingtip of a B777 was clear of a nearby object by judging if that object was seen to be above or below the level of the middle screw on the side window post on the same side of the aircraft as the pilot seat.
Figure 4 – Side view from pilot’s (left) seat, using a screw located on a window frame as a reference to judge wingtip clearance.
Collision Site Information

- Both aircraft requested to go back to parking gates for inspection after the collision.
- Collision site cleaned up when investigators arrived.
- A safety cone was placed at the position when debris was picked up.
- No measurements or photographs were taken of the site before the debris was cleared.

41
Other Findings

- The operator did not have a standing instruction for crew to have the aircraft’s damage assess after a ground collision.
- Both aircraft did not request for safety assessment of the damage before moving back to gate.
Lessons Learnt (1/2)

- Having the knowledge of the space constraint between gate F37 and taxiway C1, Ground Controller should have exercised positive controller instead of giving conditional clearance to aircraft A.
- It is the responsibility of crew to ensure aircraft separation at all times, when in doubt, stop.
- Crew should not rely solely on non-documented technique to determine wingtip clearance.
Lessons Learnt (2/2)

- Aerodrome operator to establish procedures to preserve evidence and keep a detailed record of the incident scene prior to the removal of aircraft, vehicles or evidence from the site
Runway Incursion by maintenance vehicle
What will be your action when you are notified of this occurrence?
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<td>Runway Maintenance Personnel</td>
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<td>2</td>
<td>ATCO (Interview)</td>
<td>ATC Operator</td>
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<td>Review of ATC and aerodrome procedure</td>
<td>Aerodrome Operator/ATC Operator</td>
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<tr>
<td>6</td>
<td>Review any runway video recording</td>
<td>Aerodrome Operator</td>
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Occurrence at 11:26hrs
AAIB was informed at 13:55 hrs
Reported by the maintenance personnel
Runway video recording reviewed and confirmed occurrence
Interviewed maintenance personnel
Listened to ATC recordings
Watched surface radar recording
Interviewed ATCOs
Site visit to assess tower environment
Interviewed flight crew
Review other aerodrome best practises
1. Rover 39 arrived at E4 holding point on Controller 1’s instructions.
2. Controller 3 initiated contact with Rover 39.
3. 18s later, runway incursion detected by Advanced Surface Movement Guidance and Control System (A-SMGCS).
4. 7s later, Controller 2 issued landing clearance after visual scan of runway.
5. 20s later, Rover 39 stopped here for bird carcass removal.
6. 15s later, Controller 1 noticed Rover 39 on runway and shouted.
7. Aircraft touched down.
8. 4s later, Controller 4 (taking a break) tried to communicate with Rover 39 and instructed it to vacate runway quickly.
9. 4s after Rover 39 acknowledged instruction, aircraft’s left wing passed over vehicle.

Controller 3: Rover 39 Changi Tower
Rover 39: Tower 39
Controller 3: Ok ahh... proceed for Runway 2, prepare to enter Runway 2 to pick up a bird carcass
Rover 39: Ahh... roger Tower 39 Runway 2 thank you

Synopsis:
- 18s later, runway incursion detected by A-SMGCS.
- 7s later, Controller 2 issued landing clearance after visual scan.
- 20s later, Rover 39 stopped for bird carcass removal.
- 15s later, Controller 1 noticed Rover 39 on runway and shouted.
- Aircraft touched down.
- 4s later, Controller 4 tried to communicate with Rover 39.
- 4s after Rover 39 acknowledged instruction, aircraft’s left wing passed over vehicle.

Narrative:
- Rover 39 arrived at E4 holding point on Controller 1’s instructions.
- Controller 3 initiated contact with Rover 39.
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- Aircraft touched down.
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- 4s after Rover 39 acknowledged instruction, aircraft’s left wing passed over vehicle.
Analysis and Findings

- Co-worker not authorised to perform radio-telephony communication
  - Category 1 Airfield Driving Permit required for communication, even non-drivers
  - Co-worker did not hold Category 1 ADP
  - Random checks performed by aerodrome operator focused on vehicle’s driver

- Red stop bar lights (illuminated to indicate all traffic to stop)
  - Lights switched off momentarily for aircraft after clearance given, not practised for vehicles
Analysis and Findings (cont’d)

- **Use of the A-SMGCS**
  - Volume of speakers at all five A-SMGCS terminals set to inaudible level
  - Lack of operational emphasis and formal training on A-SMGCS
    - No procedure to require volume setting to be checked
    - No structured format or formal syllabus for A-SMGCS training
  - A-SMGCS could provide critical information even in good-visibility
  - Full capabilities of the A-SMGCS not harnessed
Safety Actions

- **Radio-telephony communication**
  - Runway maintenance company no longer allows unauthorised personnel to perform radio-telephony communication with ATC
  - Aerodrome operator enhanced method of compliance check
  - Circular issued to ground operation companies and air traffic controllers on:
    - Personnel and equipment requirements for airside driving
    - Examples of standard phraseology usage
Safety Actions

- **Air-traffic control**
  - Controllers reminded to be vigilant about traffic conditions, use standard phraseology and give concise instructions.
  - Volume of A-SMGCS speakers are now pre-set and not adjustable.
  - Aural warning function tested at start of each shift.
  - Standard phraseology checks on ground frequency channel.
  - Single frequency communication for all operations on a runway being explored.
Safety Actions

- Entrance into runway
  - Switch off red stop bar lights for vehicles entering runway by July 2014 (to standardise practice for aircraft and vehicles)
  - Microwave barrier detectors to be installed at all runway entrances by December 2014

- Others
  - Runway maintenance contractor require vehicles on runway parked facing landing direction
    - Aerodrome operator evaluating widespread implementation of this practice
  - Runway safety measures review by runway safety specialist planned by aerodrome operator
Safety Recommendations

- **Air navigation service:**
  - The air navigation service provider adopt a more systematic approach to utilise the full capabilities of the A-SMGCS, even in good visibility conditions, to assist the controllers in performing their duties.

- **Flight recorder deactivation:**
  - The airline operator review its procedures to ensure that flight recorders are deactivated at the end of a flight following a significant occurrence.
  - The regulatory authority ensure that the Singapore Air Operator Certificate holders have procedures implemented to meet the requirement in paragraph 37(4) of the Air Navigation Order regarding deactivation of flight recorders upon completion of a flight following an accident or a serious incident.
End

Session 8

Case Study