The Crash of Asiana flight 214

Robert L. Sumwalt, III

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Asiana flight 214

- July 6, 2013
- San Francisco, California
- 3 Fatalities
General Details

- 10 ½ hour flight from Korea
- Clear skies, light winds
- About 1128 am local time
- Visual approach
- Glideslope out of service
- 3 Fatal injuries
- 49 serious injuries
- 138 minor injuries
- 117 no injuries
Arrival Information

1119:25  9000 Feet
1120:57  7700 Feet
1121:57  6000 Feet
1123:17  4500 Feet

SFO Airport
Pilot Roles and Experience

• LEFT SEAT: Pilot Flying
  - 9,700 hours total
  - 45 hours in B777

• RIGHT SEAT: Instructor Pilot
  - 12,000 hours total
  - 3,200 hours in B777
  - New B777 instructor, first trip as instructor

• JUMPSEAT: Relief Pilot (First Officer)
Photos are for orientation purposes only and do not reflect the exact status of the accident airplane.
777 Mode Control Panel

Flight Level Change (FLCH) Button

Altitude Select Window
Final Approach Before FLCH Selected
Final Approach: FLCH SPD Selected
Final Approach: A/T in HOLD mode
777 AT Wake-up

- If the autothrottles are disconnected, if speed gets too slow, the autothrottles will reactivate ("wake up") and increase speed.
- If autothrottles are armed in their normal operating mode, but in HOLD mode, if speed gets slow, the autothrottles will not wake up.
Final Approach

- Flight passed through a 3° glidepath at about 500 feet
- Stabilized approach criteria not met
- Descent rate 1,200 fpm, throttles remained at idle
Final Approach

• PM – “speed” at 90 ft and 110 knots
• PM – added go-around thrust
• Column full aft
• Stick shaker activated
• Airplane did not have the performance to go around at that point
Estimated aircraft position at impact with seawall
The Big Question

How could an airline crew crash an airplane on a perfectly clear day with calm winds on a visual approach?
Some Answers

• Poor monitoring due to expectancy, increased workload, fatigue, and automation reliance

• Complexities in the 777 automation and inadequacies in related training and documentation
  - Led to PF’s inadvertent deactivation of automatic airspeed control
Autothrottle failing to wake up

- August 2010 - 787 certification test flight.
  - FAA test pilot noted concern
  - Autothrottle behavior “less than desirable”
Autothrottle failing to wake up - EASA Concerns -

- “although the … ‘Autothrottle wake up’ feature is not required per certification requirements, these two exceptions look from a pilot’s perspective as an inconsistency in the automation behavior of the airplane.”

- “the manufacturer would enhance the safety of the product by avoiding exceptions in the ‘Autothrottle wake up’ mode condition.”
During a descent in FLCH mode or VNAV SPD mode, the A/T may activate in HOLD mode. When in HOLD mode, the A/T will not wake up even during large deviations from target speed and does not support stall protection.
Autothrottle failing to wake up

• PF’s ground instructor
  - “anomaly”
  - Happened to him 3 times
“If the autothrottle automatic engagement function (“wakeup”), or a system with similar functionality, had been available during the final approach, it would likely have activated and increased power about 20 seconds before impact, which may have prevented the accident.”
Autothrottle failing to wake up

- Large US-based 777 operator
- Another airline estimates – 3 times a day
- Another airline: speed decreased 19 knots below $V_{\text{ref}}$
- “It is true that the HOLD mode is poorly understood by the industry, and absolutely this accident could have happened in any airline.”
Profile View of Approach

CALCULATED PILOT EYE HEIGHT

PAPI GUIDANCE

ALTITUDE (FEET)

DISTANCE TO RUNWAY 28L DISPLACED THRESHOLD (NAUTICAL MILES)
CAM-3: sink rate sir.
HOT-1: cleared to land {?}
Animation is available at:

- http://www.youtube.com/watch?v=8MFPSfGoT1U&feature=youtu.be

Or scroll to bottom of NTSB home page and look here
Safety Issues

- Flightpath management
- Adherence to standard operating procedures
- Flight crew monitoring
- Flight instructor operating experience proficiency
- Manual flight proficiency
- Understanding of autothrottle system logic
Safety Issues

• B777 autoflight system airspeed control
• Appropriate use of flight directors
• Low energy alerting systems
• Injury potential from lateral forces
• Slide/raft certification standards
• ARFF training and staffing
• San Francisco Airport emergency procedures
Monitoring

Airspeed Monitoring Lapses

- PM ≈ 17 Seconds
- PF > 24 Seconds

200 Feet

Low Speed Alert

Thrust Levers
Move Forward

Shaker

Calibrated Airspeed (Knots)

Radar Altitude (Feet)
“Insufficient flight crew monitoring of airspeed indications during the approach likely resulted from expectancy, increased workload, fatigue, and automation reliance.”
NTSB Finding

“A context-dependent low energy alert would help pilots successfully recover from unexpected low energy situations like the situation encountered by the accident pilots.”
Probable Cause

- The flight crew’s mismanagement of the airplane’s descent during the visual approach.
- The pilot flying’s unintended deactivation of automatic airspeed control.
- The flight crew’s inadequate monitoring of airspeed.
- The flight crew’s delayed execution of a go-around after they became aware that the airplane was below acceptable glidepath and airspeed tolerances.
Contributing to the accident:

(1) The complexities of the autothrottle and autopilot flight director systems that were inadequately described in Boeing’s documentation and Asiana’s pilot training, which increased the likelihood of mode error.

(2) The flight crew’s nonstandard communication and coordination regarding the use of the autothrottle and autopilot flight director systems.

(3) The pilot flying’s inadequate training on the planning and executing of visual approaches.

(4) The pilot monitoring/instructor pilot’s inadequate supervision of the pilot flying.

(5) Flight crew fatigue which likely degraded their performance.
27 Recommendations

- FAA (15)
- Asiana Airlines (4)
- Boeing (2)
- ARFF Working Group (4)
- City of San Francisco (2)
“From tragedy we draw knowledge to improve the safety of us all.”