

How could they have done that?

Case studies of two aircraft accidents

Robert Sumwalt

How could they have done that?

COMAIR 5191



NTSB

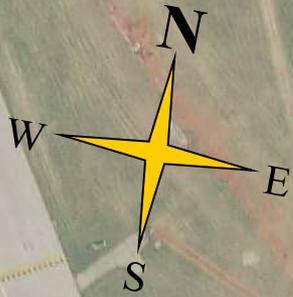
Comair Airlines Flight 5191

Lexington, Kentucky

- Bombardier CRJ
- 49 Fatalities
- August 27, 2006
- Wrong runway takeoff attempt







27

Taxiway A5

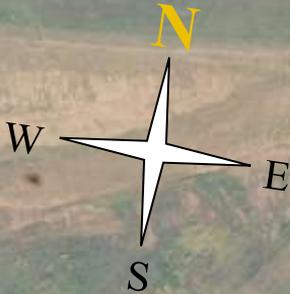
Taxiway A7

26

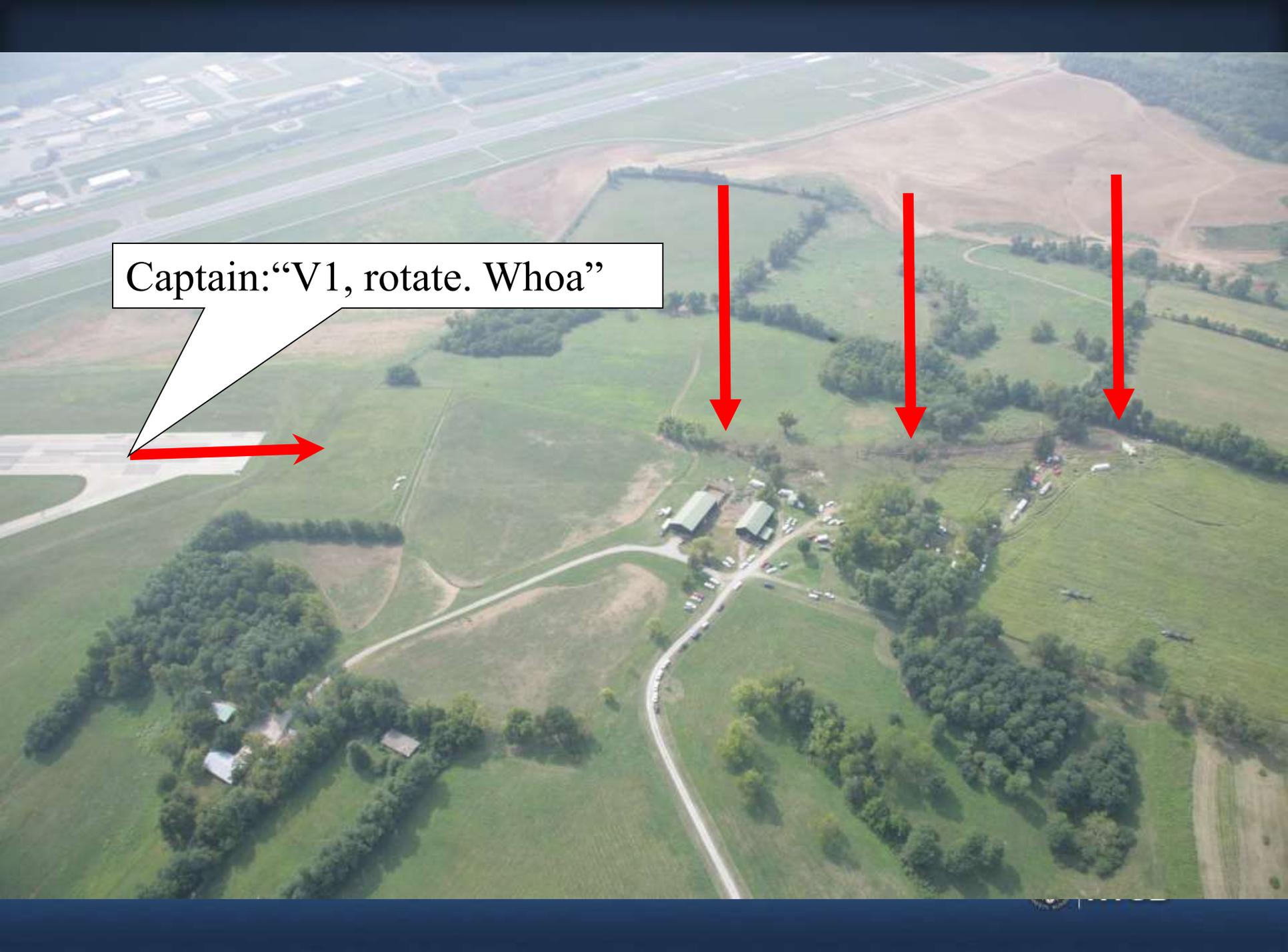
Taxiway A



ATC: "...fly runway heading. Cleared for takeoff."



Captain: "V1, rotate. Whoa"





Right main gear

Left main gear

Nose gear



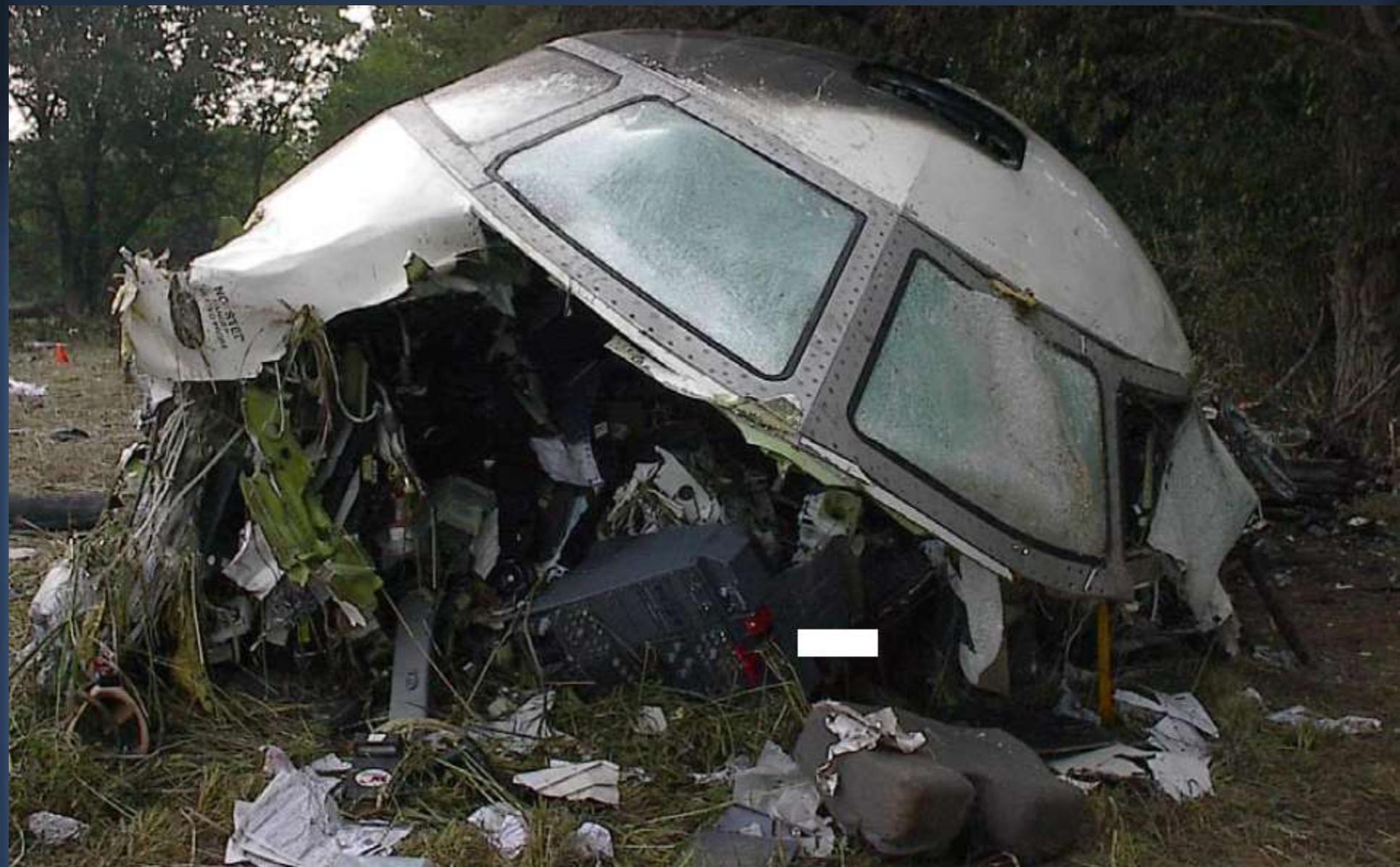
NTSB



NTSB



NTSB



NTSB

Potential ATC Issues

- One controller on duty vs. two
- Controller fatigue
- Controller task prioritization



Potential Airport Issues

- Taxiway identifiers on chart were inaccurate
- NOTAM not available to crew
 - flight crew paper work
 - ATIS





A-6

Operational Issues

- Noncompliance with sterile cockpit rule
 - 40 of the 150 seconds during taxi were violations of sterile cockpit rule
- Distraction likely contributed to loss of positional awareness
- Setting tone during preflight
 - Abbreviated taxi briefing
 - Casual and relaxed
 - Checklist “at your leisure”





Time	Who	Statement / editorial comment
05:52.11	Capt.	"I'm easy buddy."



Time	Who	Statement / editorial comment
05:52.11	Capt.	"I'm easy buddy."
05:56:14	Capt.	"run the checklist at your leisure."

Time	Who	Statement / editorial comment
05:52.11	Capt.	"I'm easy buddy."
05:56:14	Capt.	"run the checklist at your leisure."
05:57:36	Capt.	"Before starting, at your leisure."



Time	Who	Statement / editorial comment
05:52.11	Capt.	"I'm easy buddy."
05:56:14	Capt.	"run the checklist at your leisure."
05:57:36	Capt.	"Before starting, at your leisure."
05:58:12	Capt.	"Start engines, your leisure."



Time	Who	Statement / editorial comment
05:52.11	Capt.	"I'm easy buddy."
05:56:14	Capt.	"run the checklist at your leisure."
05:57:36	Capt.	"Before starting, at your leisure."
05:58:12	Capt.	"Start engines, your leisure."
05:59:42	Capt.	"he said it's okay to turn one at your leisure."

Time	Who	Statement / editorial comment
05:52:11	Capt.	"I'm easy buddy."
05:56:14	Capt.	"run the checklist at your leisure."
05:57:36	Capt.	"Before starting, at your leisure."
05:58:12	Capt.	"Start engines, your leisure."
05:59:42	Capt.	"he said it's okay to turn one at your leisure."
05:59:45 to 06:01:47		<i>Crew engages in two minutes of non-pertinent conversation during engine start</i>

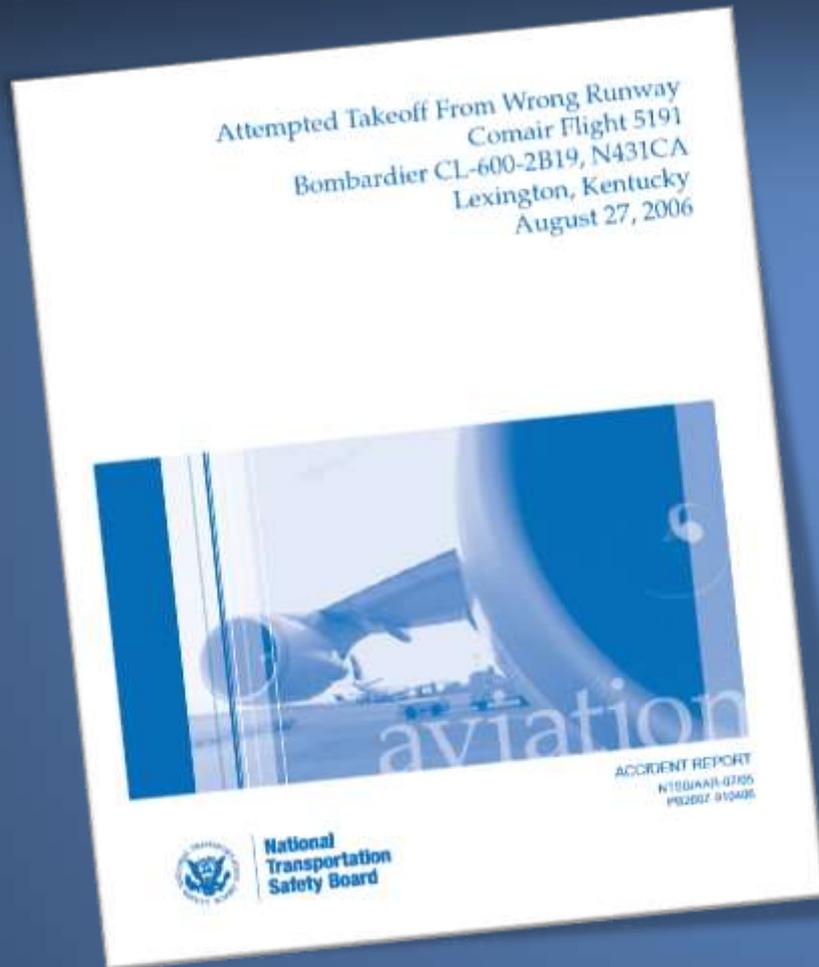
Time	Who	Statement / editorial comment
05:52.11	Capt.	"I'm easy buddy."
05:56:14	Capt.	"run the checklist at your leisure."
05:57:36	Capt.	"Before starting, at your leisure."
05:58:12	Capt.	"Start engines, your leisure."
05:59:42	Capt.	"he said it's okay to turn one at your leisure."
05:59:45 to 06:01:47		<i>Crew engages in two minutes of non-pertinent conversation during engine start</i>
06:03:12	Capt.	"finish it up, your leisure."

Time	Who	Statement / editorial comment
05:52:11	Capt.	"I'm easy buddy."
05:56:14	Capt.	"run the checklist at your leisure."
05:57:36	Capt.	"Before starting, at your leisure."
05:58:12	Capt.	"Start engines, your leisure."
05:59:42	Capt.	"he said it's okay to turn one at your leisure."
05:59:45 to 06:01:47		<i>Crew engages in two minutes of non-pertinent conversation during engine start</i>
06:03:12	Capt.	"finish it up, your leisure."
06:03:16		<i>First officer initiates and captain participates in, 40 seconds of nonpertinent conversation.</i>

Time	Who	Statement / editorial comment
05:52:11	Capt.	"I'm easy buddy."
05:56:14	Capt.	"run the checklist at your leisure."
05:57:36	Capt.	"Before starting, at your leisure."
05:58:12	Capt.	"Start engines, your leisure."
05:59:42	Capt.	"he said it's okay to turn one at your leisure."
05:59:45 to 06:01:47		<i>Crew engages in two minutes of non-pertinent conversation during engine start</i>
06:03:12	Capt.	"finish it up, your leisure."
06:03:16		<i>First officer initiates and captain participates in, 40 seconds of nonpertinent conversation.</i>
06:05:15	F/O	"churlieser [<i>'at your leisure'</i> spoken very fast], Comair one twenty one ready to go."



NTSB Finding



“The flight crew’s noncompliance with standard operating procedures... and both pilots’ nonpertinent conversation, most likely created an atmosphere in the cockpit that enabled the crew’s errors.”

A fine line

- “There is a fine line separating a relaxed and easy atmosphere in a cockpit from a lax one where distractions can result in critical failures.”
- “Professionalism may be described as knowing the difference between the two.”
 - Honorable John K. Lauber

Probable Cause

“Flight crewmembers’ failure to use available cues and aids to identify the airplane’s location on the airport surface during taxi and their failure to cross-check and verify the airplane was on the correct runway before takeoff.

Contributing to the accident [was] the flight crew’s nonpertinent conversation during taxi, which resulted in a loss of positional awareness ...”





NTSB

How could they have done that?

ASIANA 214



NTSB

Asiana flight 214



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





NTSB



NTSB



NTSB



NTSB



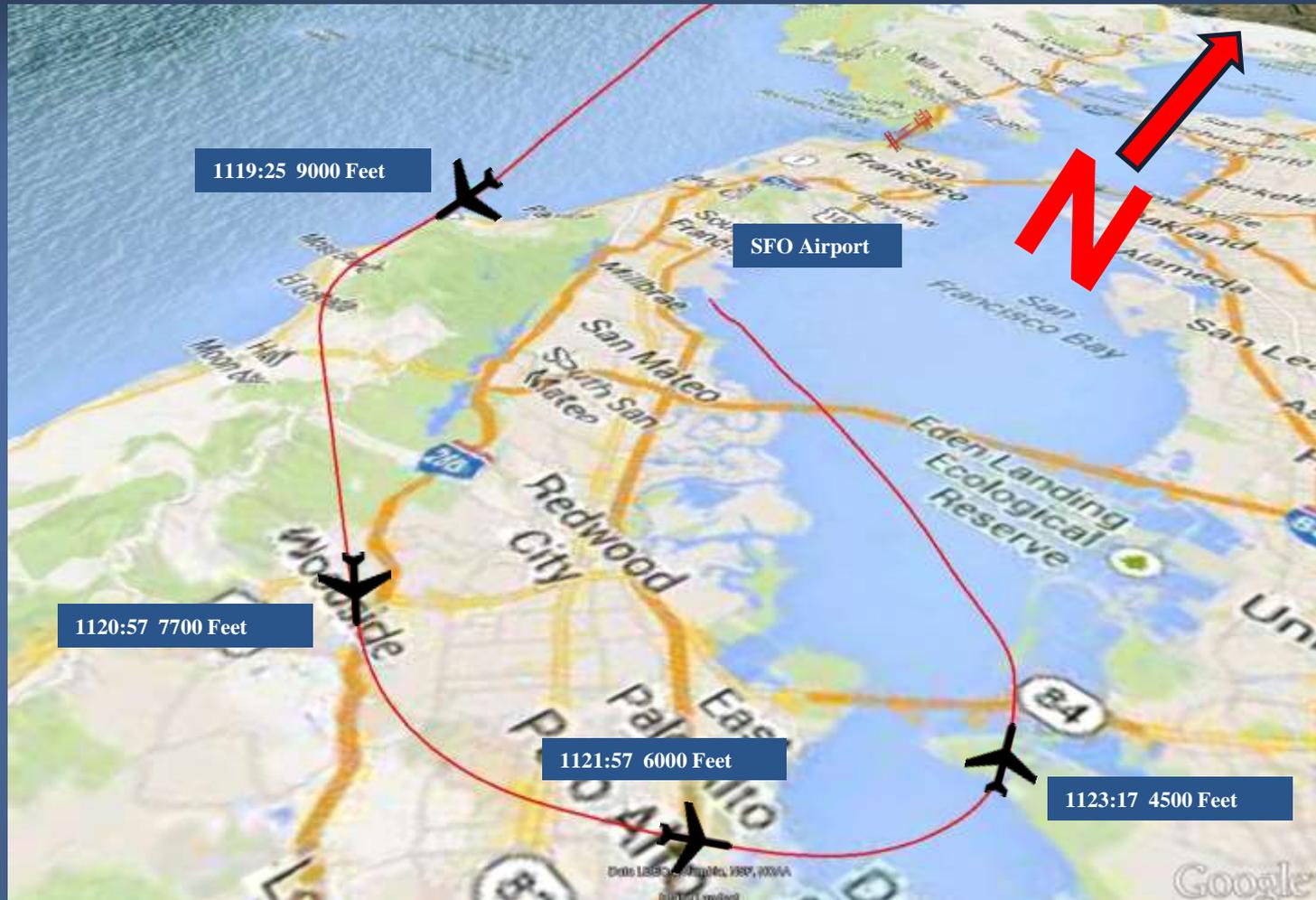
NTSB

General Details

- 10 ½ hour flight from Korea
- Clear skies, light winds
- About 11:28 am local time (3:28 am Korean time)
- Visual approach
- Glideslope out of service
- 3 Fatal injuries
- 49 serious injuries
- 138 minor injuries
- 117 no injuries



Arrival Information



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)



Flight Mode Annunciator

Mode Control Panel



Primary Flight Display

Disconnect switches

Photos are for orientation purposes only and do not reflect the exact status of the accident airplane.

777 Mode Control Panel

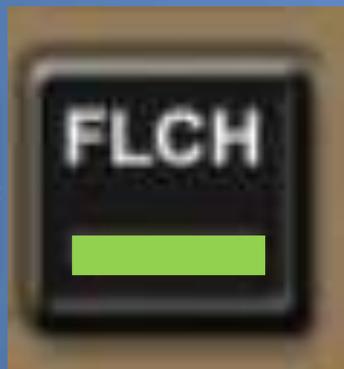


**Flight Level Change
(FLCH) Button**

**Altitude Select
Window**



5000 feet



CLIMB Thrust



Altitude Above You

IDLE Thrust



Altitude Below You



NTSB

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.



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

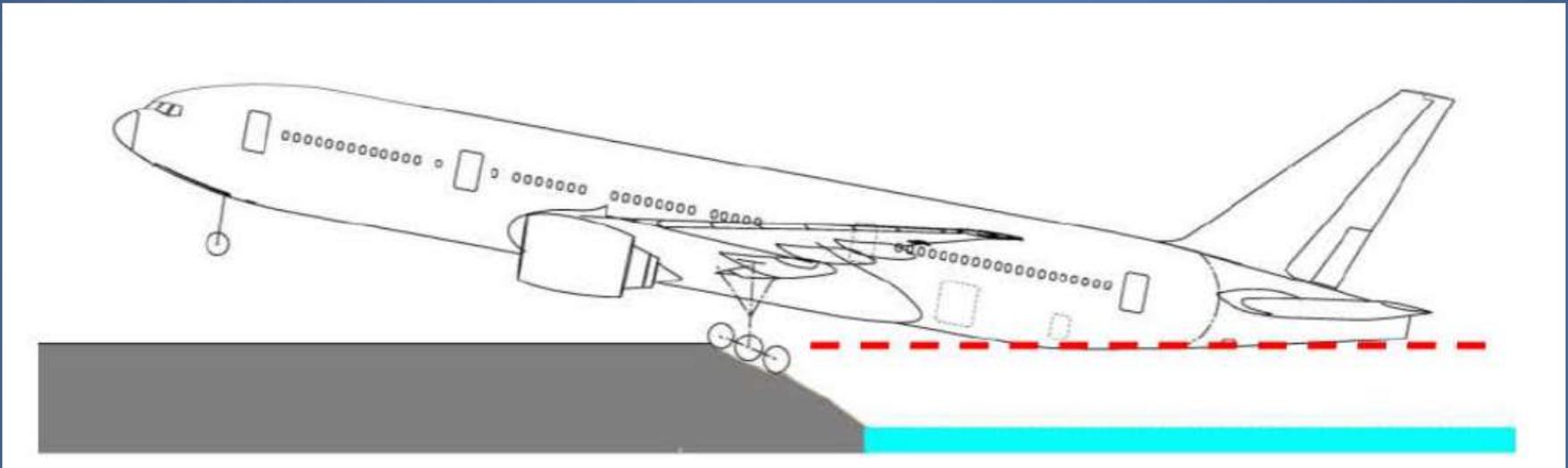
- Flight passed through a 3° glidepath at about 500 feet
- Stabilized approach criteria not met
- Descent rate 1,200 fpm, throttles remained at idle



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



NTSB

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.”



Autothrottle failing to wake up

Addition to 787 Manual

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.

Addition to 777 Manual

Autothrottle failing to wake up

- PF's ground instructor
 - “anomaly”
 - Happened to him 3 times

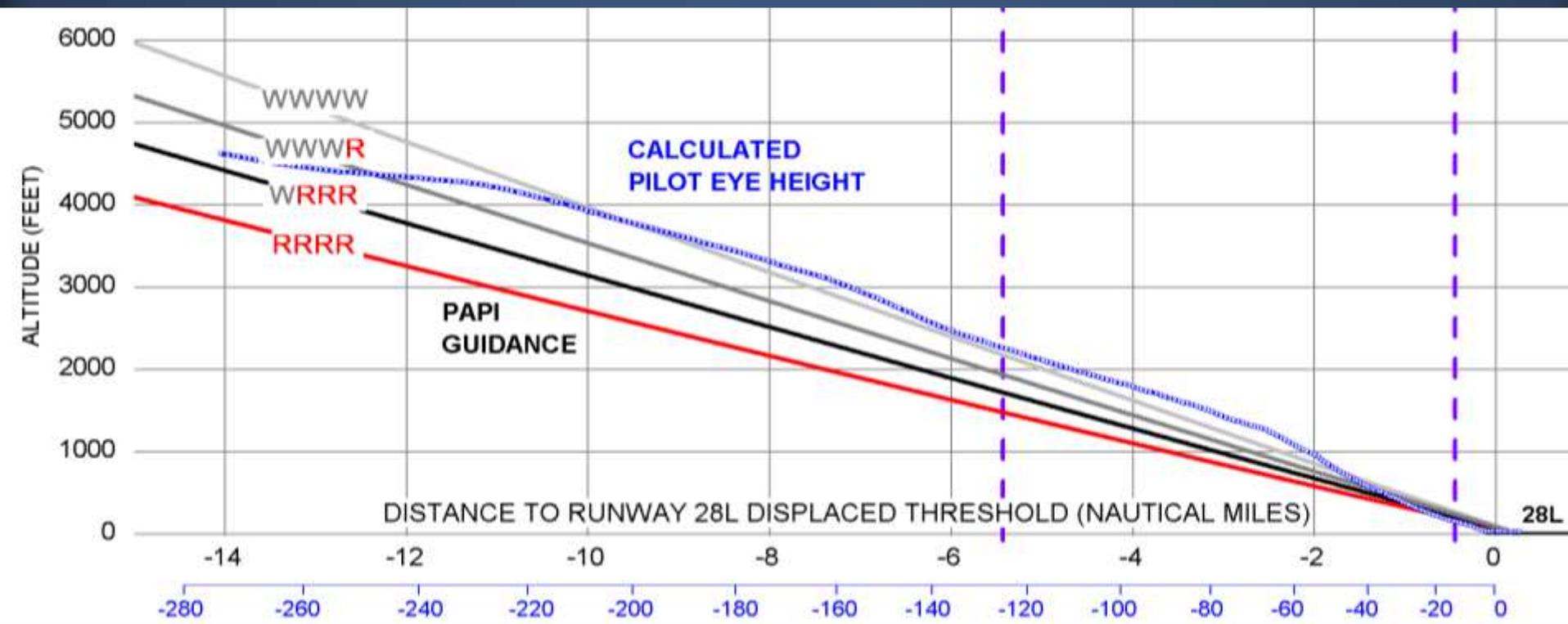


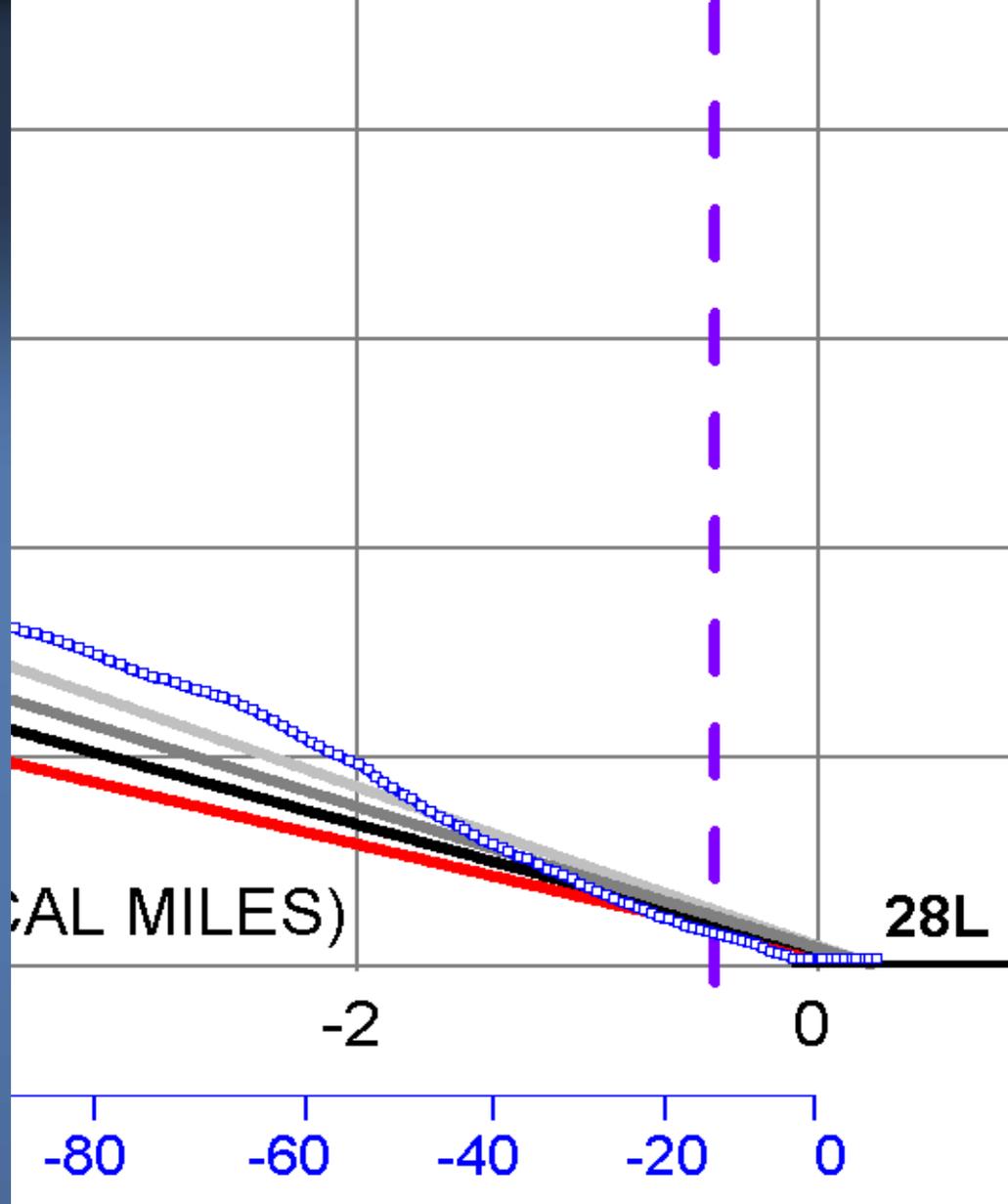
NTSB Finding

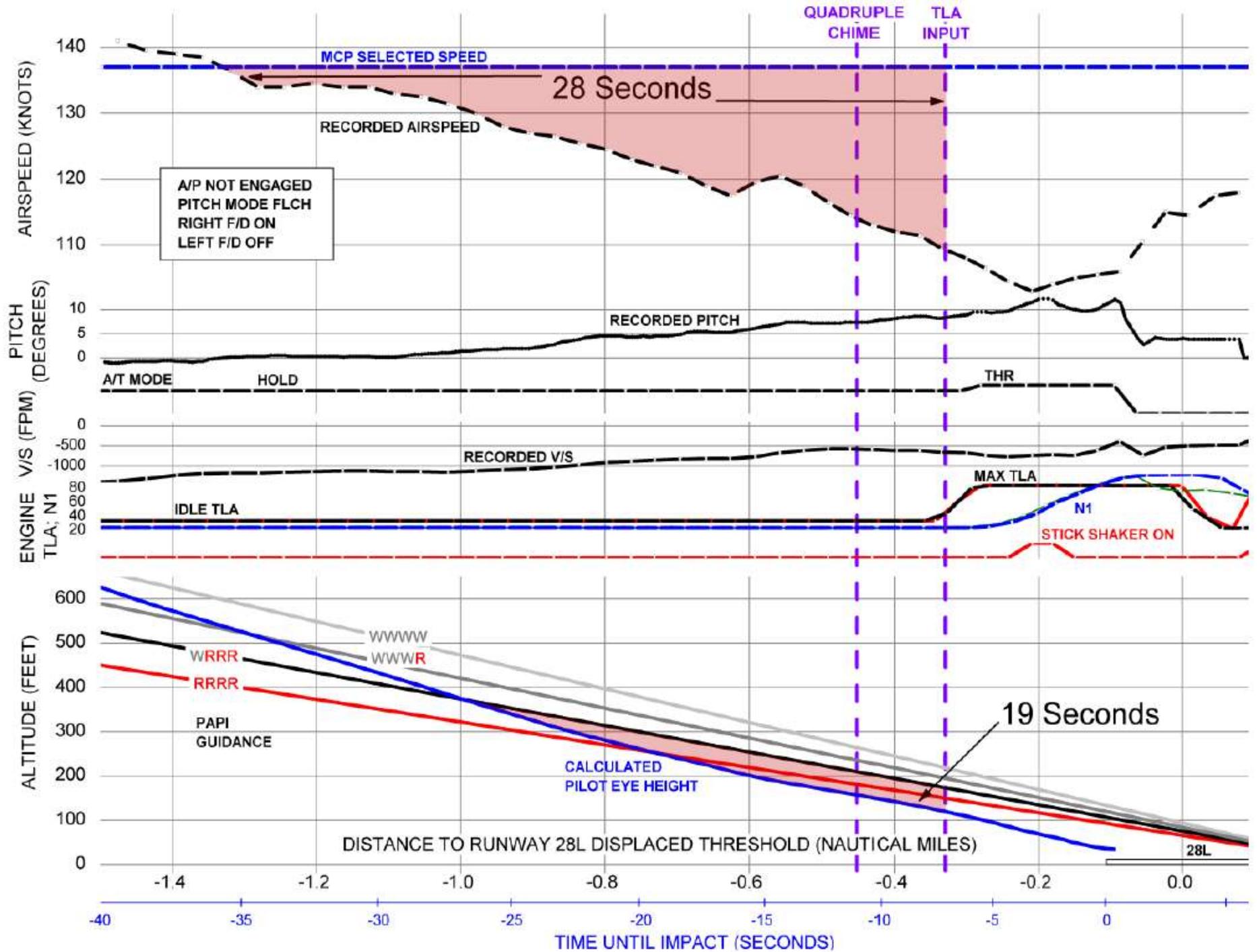
“If the autothrottle automatic engagement function (“wakeup”), or a system with similar functionality, had been available during the final approach, it would likely have activated and increased power about 20 seconds before impact, which may have prevented the accident.”



Profile View of Approach







NTSB Finding

“Insufficient flight crew monitoring of airspeed indications during the approach likely resulted from expectancy, increased workload, fatigue, and automation reliance.”



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.





National Transportation Safety Board