



**National
Transportation
Safety Board**

A Tale of Two Cities

**The San Francisco Crash
The Birmingham Crash**

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Chapter 1: San Francisco



NTSB

Asiana flight 214



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



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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.



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777 Mode Control Panel



**Flight Level Change
(FLCH) Button**

**Altitude Select
Window**



5000 feet



CLIMB Thrust



Altitude Above You

IDLE Thrust



Altitude Below You



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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

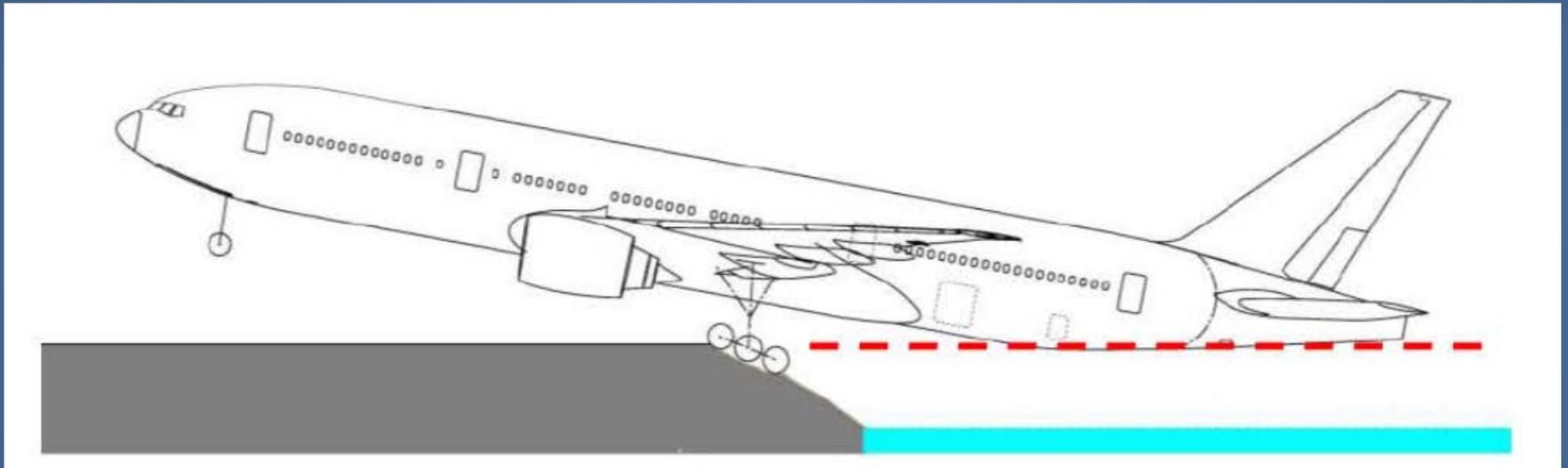
- Flight passed through a 3° glidepath at about 500 feet
- Stabilized approach criteria not met
- Descent rate 1,200 fpm, throttles remained at idle



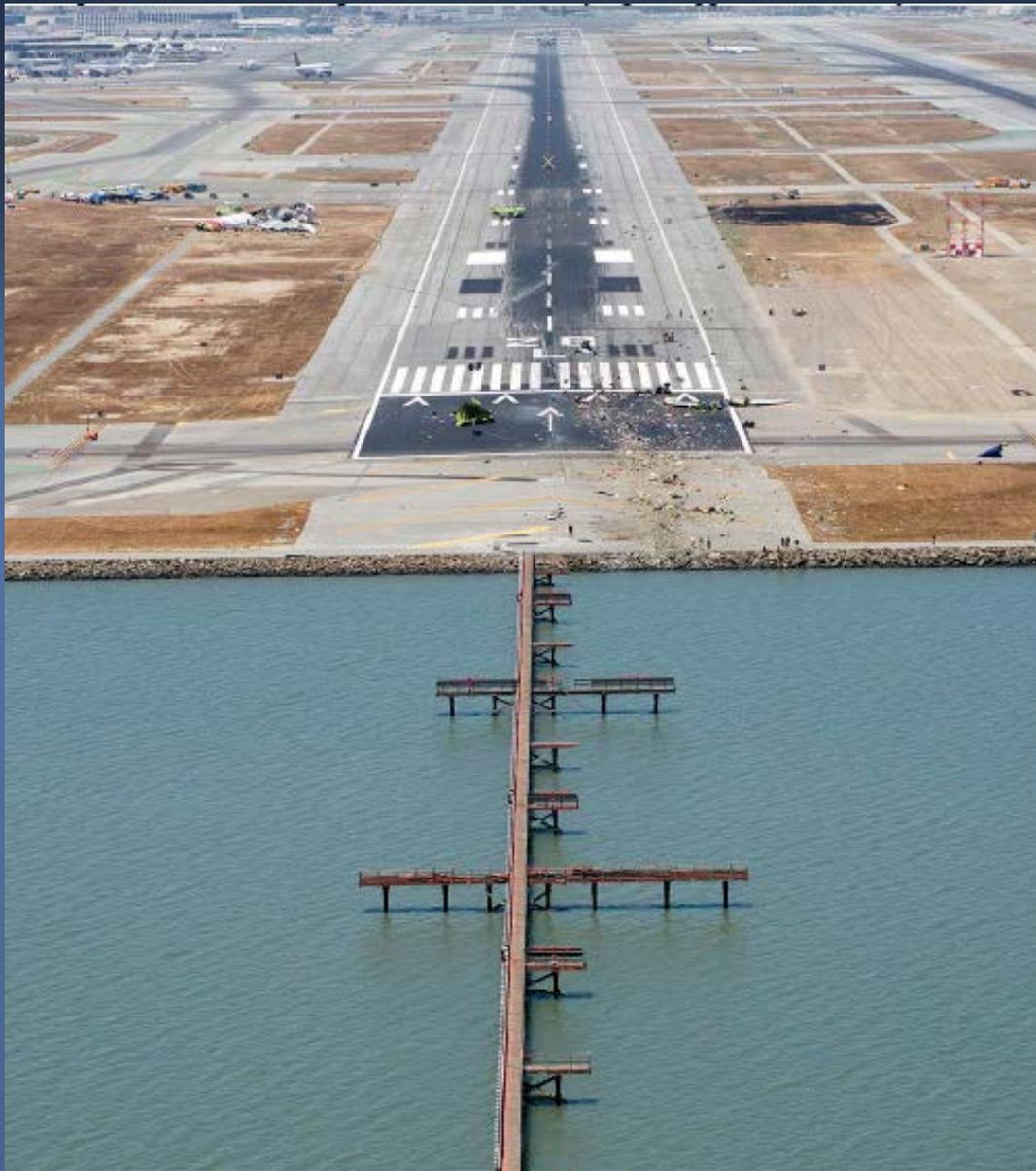
Final Approach

- 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



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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

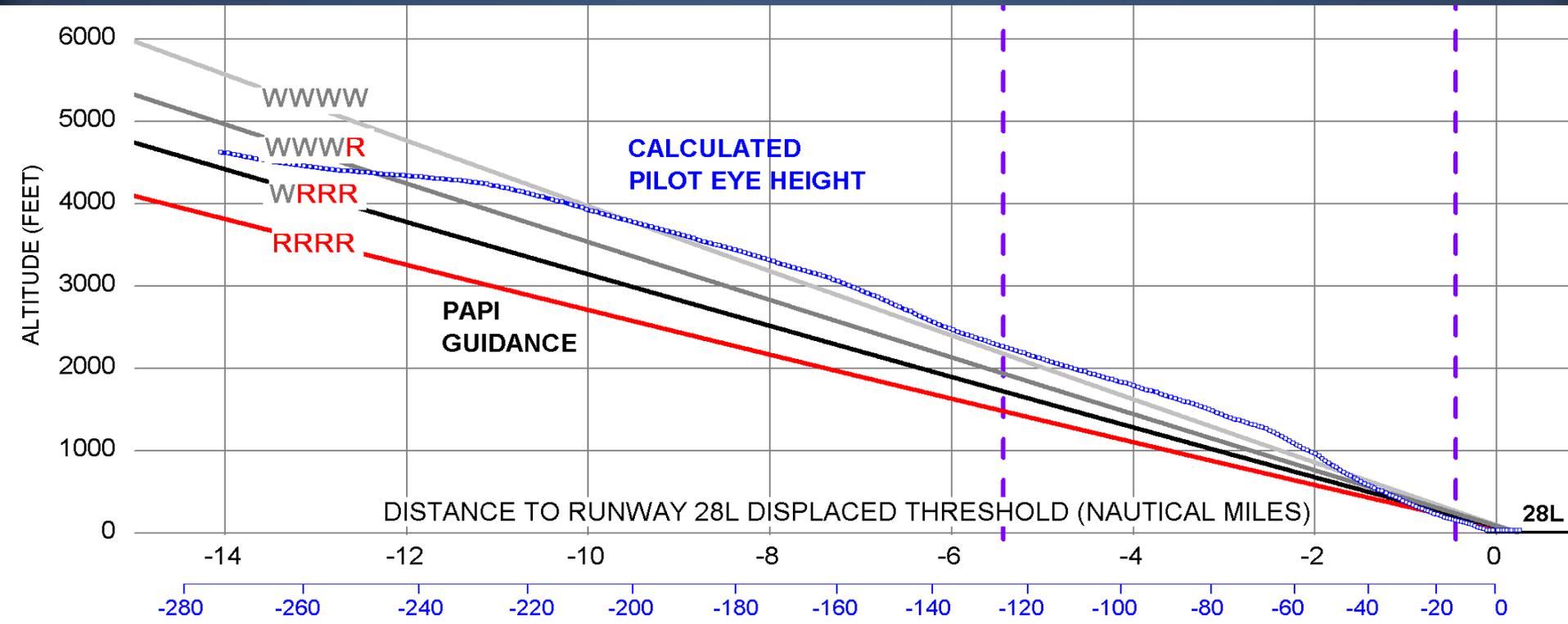
- PF's ground instructor
 - “anomaly”
 - Happened to him 3 times

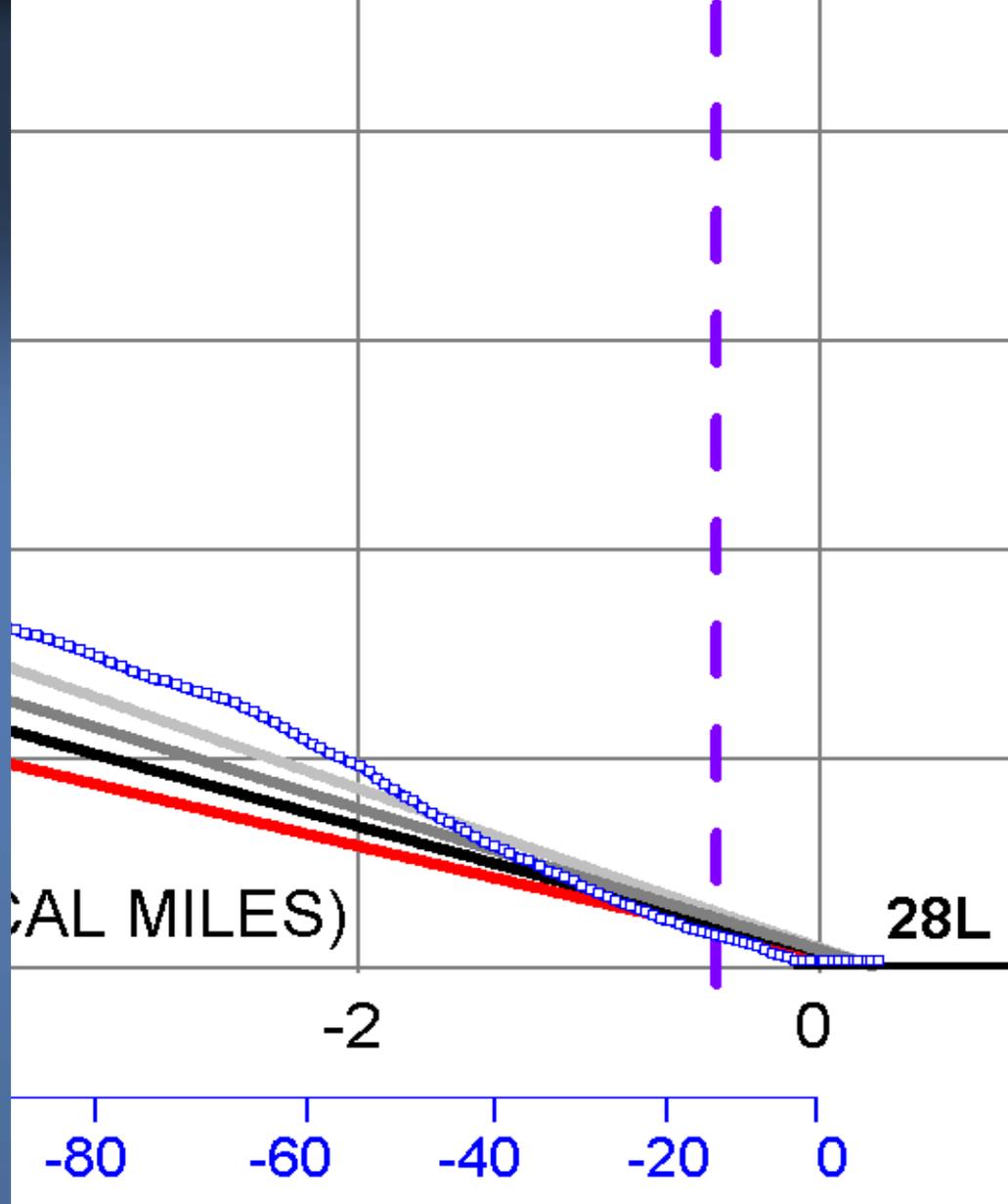


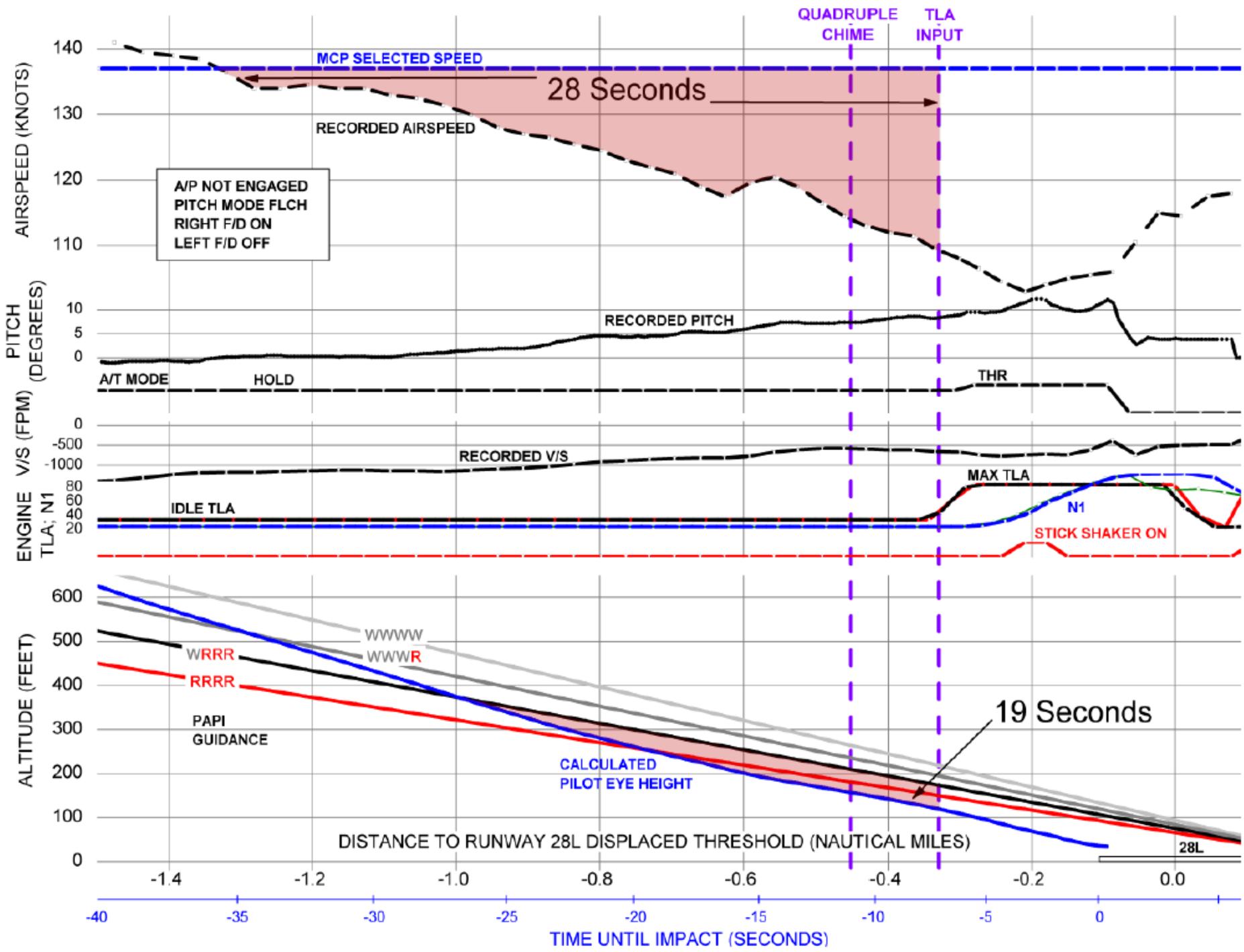
NTSB Finding

“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.”

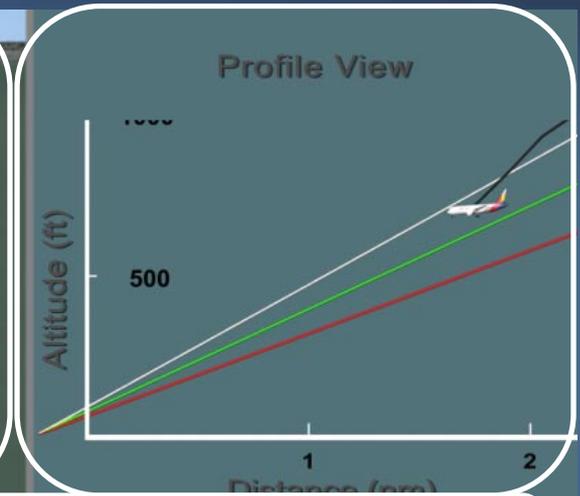
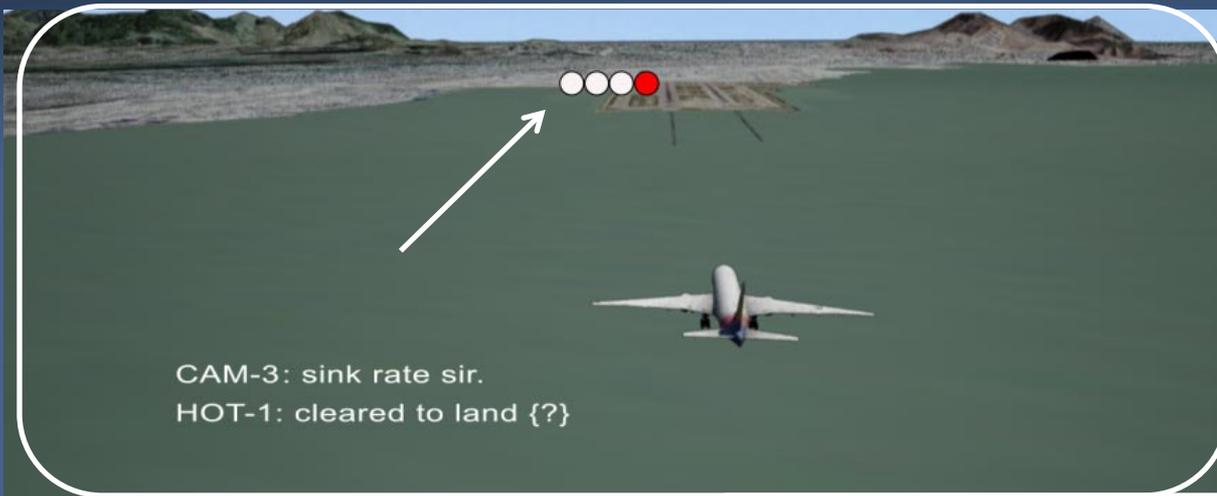
Profile View of Approach







Animation Items



HOLD | LOC | FLCH SPD **145** knots **680** feet **11:27:06**

The instrument panel shows a central airspeed indicator with a blue upper half and a brown lower half. The airspeed is 145 knots. To the right is an altitude indicator showing 680 feet. Below the airspeed indicator, the text 'Stickshaker ON' and 'Airspeed Low' is displayed in yellow. To the right are 'Thrust Levers' and 'Flap' indicators. The thrust levers are at 1.6 nm to 28L. The flap indicator shows the flap is at 30 degrees.

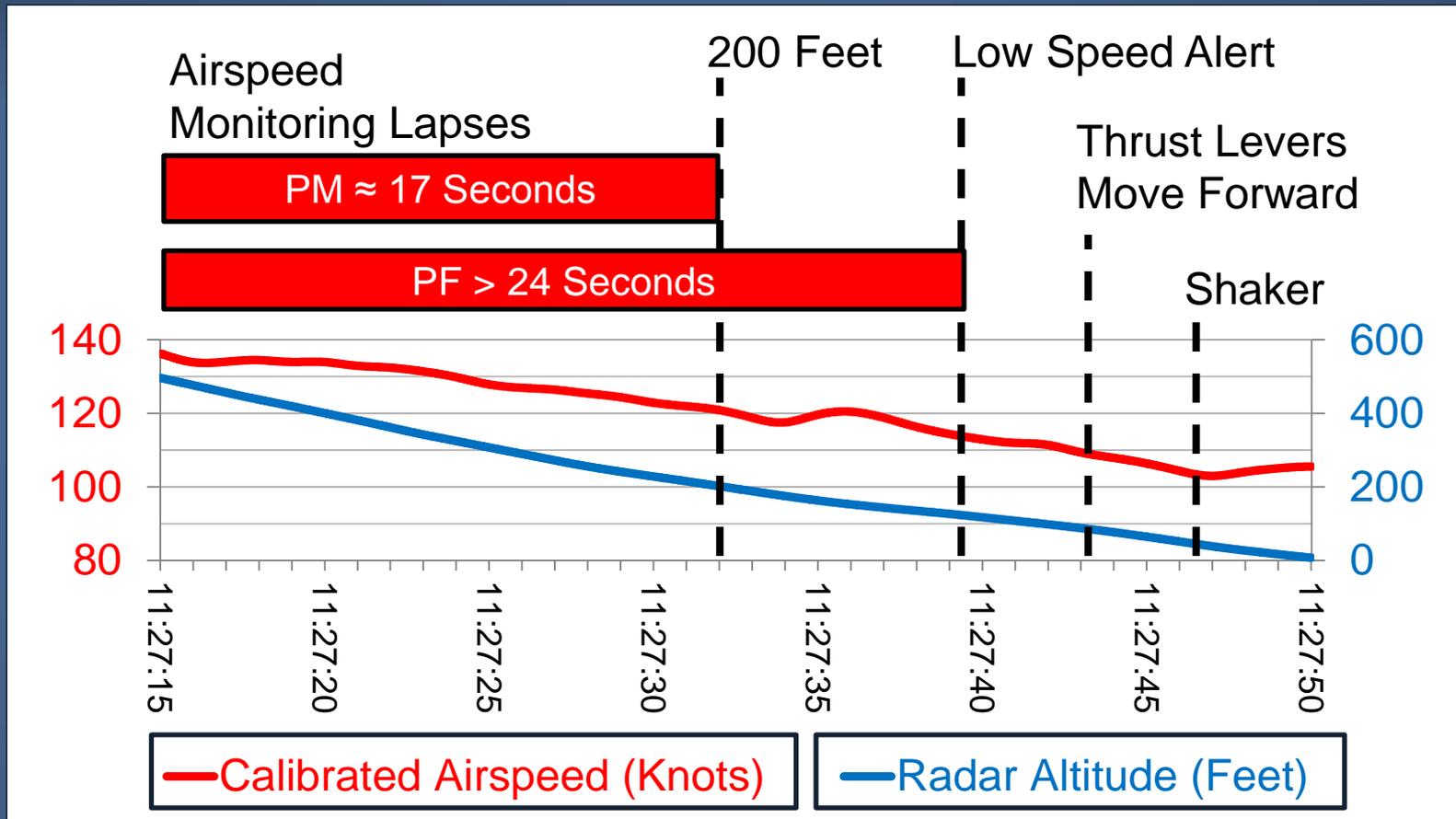


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Descent Below Visual Glidepath and Impact with Seawall

Asiana Airlines Flight 214
Boeing 777-200ER, HL7742
San Francisco, California
July 6, 2013
DCA13MA120

Monitoring



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.



27 Recommendations

- FAA (15)
- Asiana Airlines (4)
- Boeing (2)
- ARFF Working Group (4)
- City of San Francisco (2)



Chapter 2: Birmingham



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UPS flight 1354



- August 14, 2013
- Birmingham, AL
- 4:47 am
- 2 fatalities

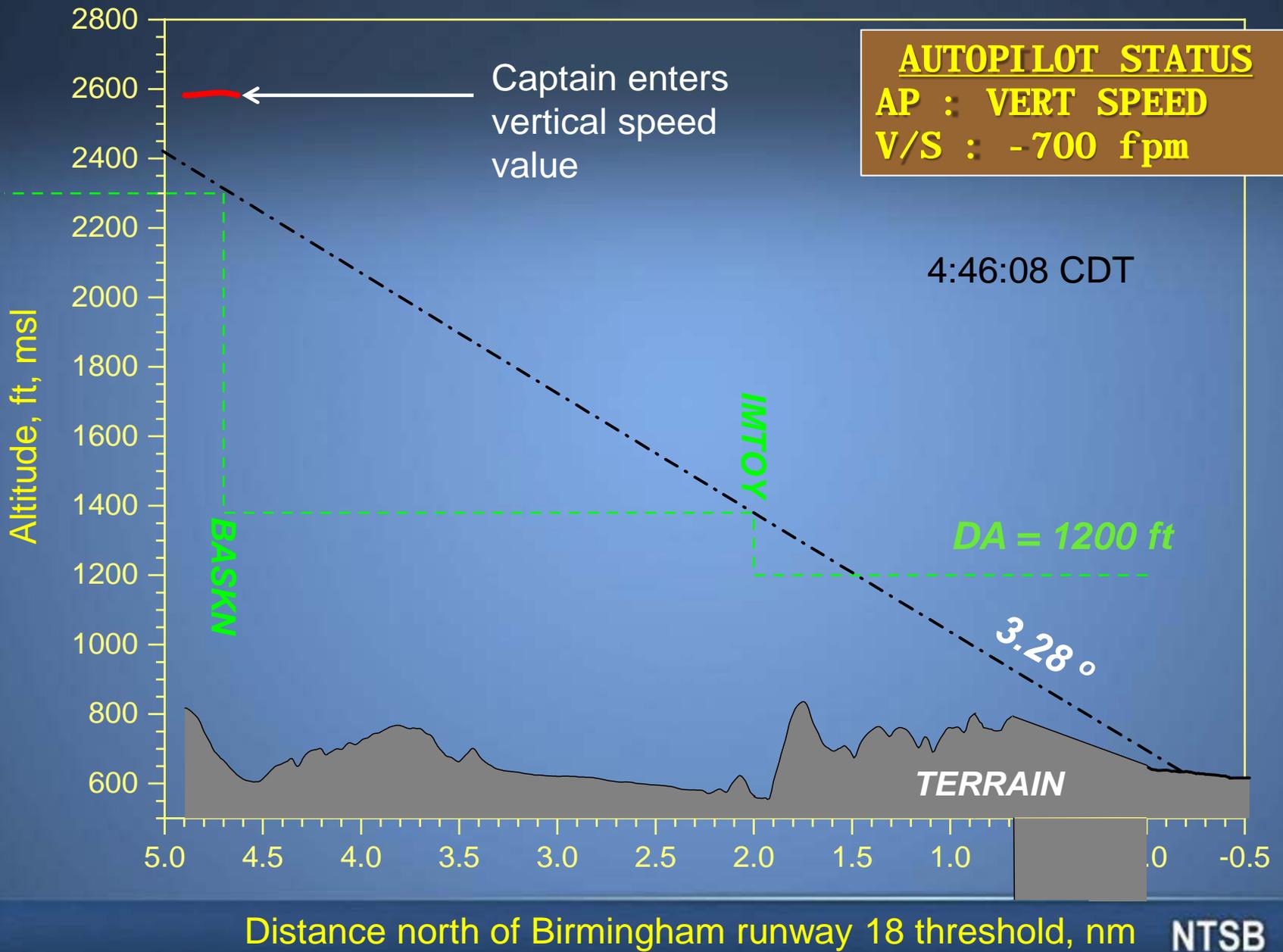


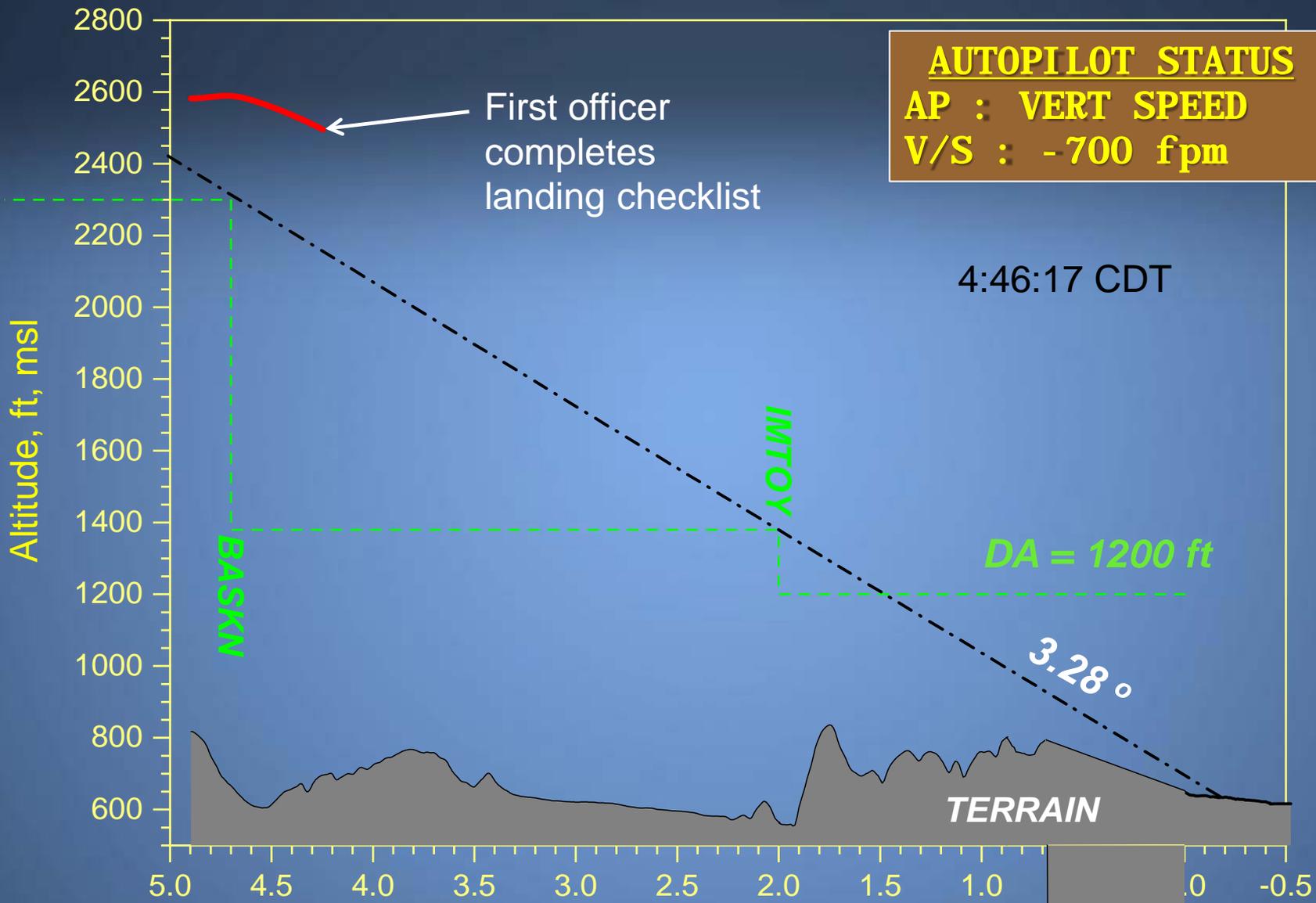


Sequence of Events

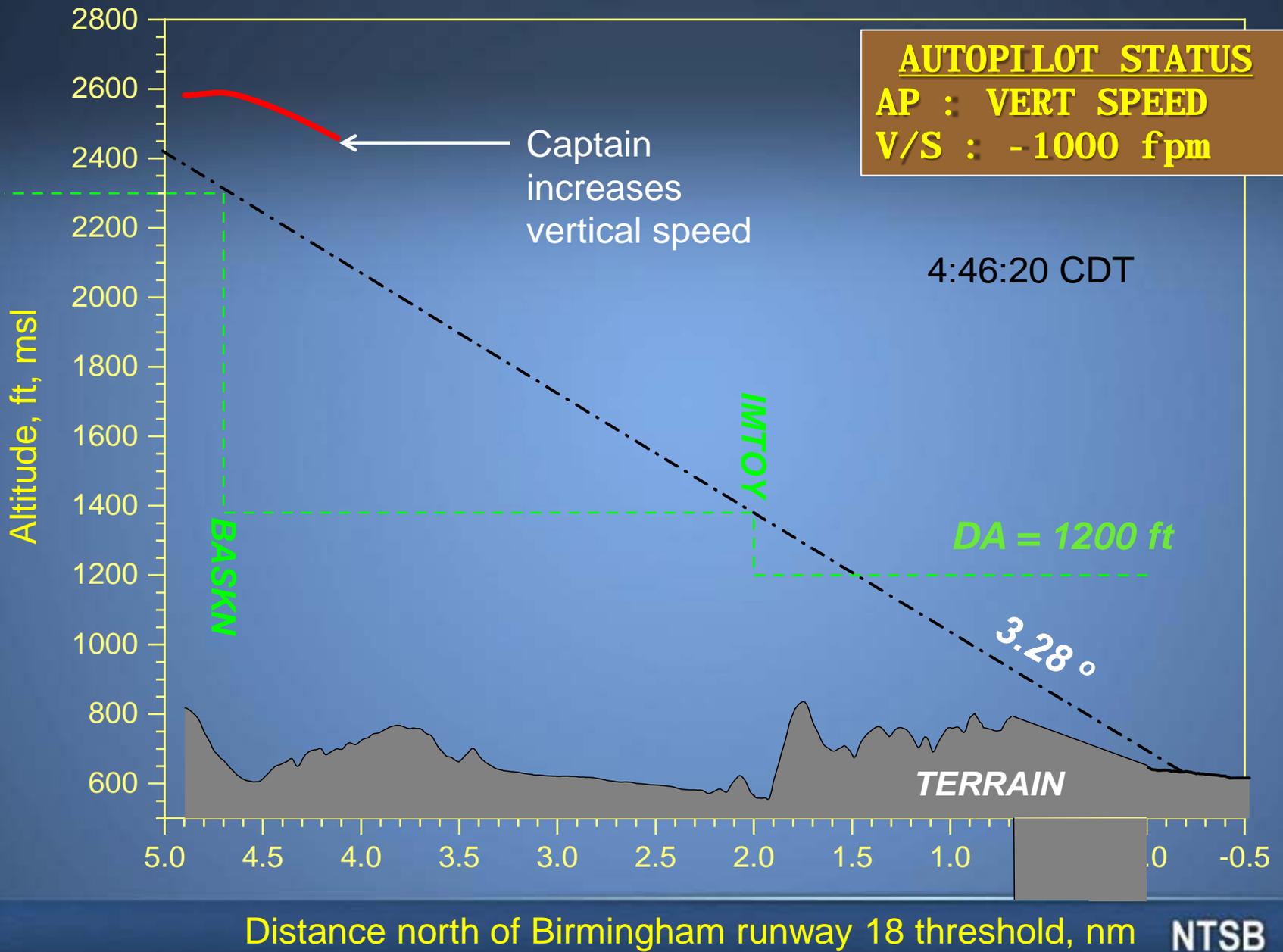
- Captain: pilot flying
- First officer: pilot monitoring
- Runway 6/24 closed for repairs between 0400 and 0500 local time

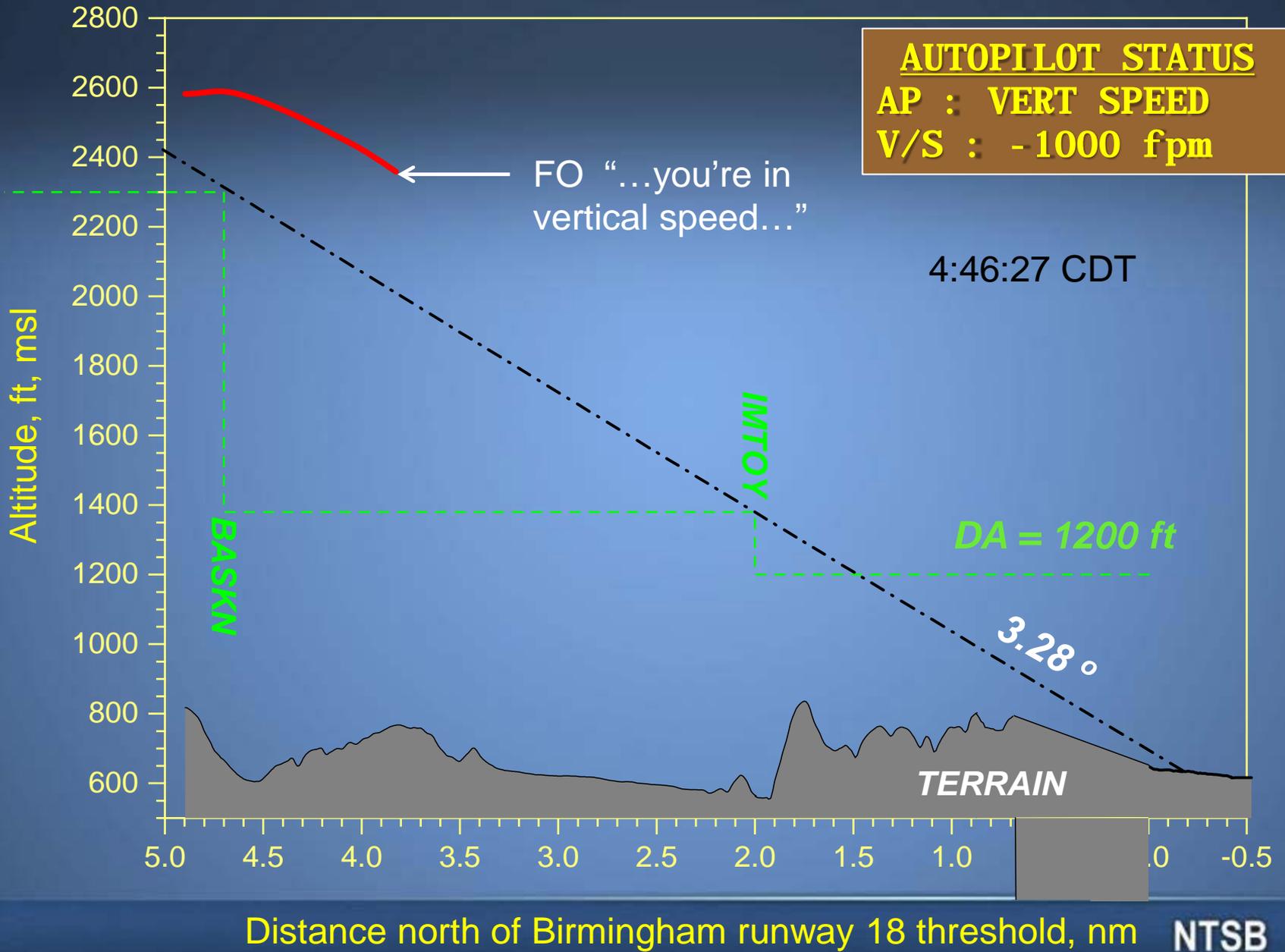


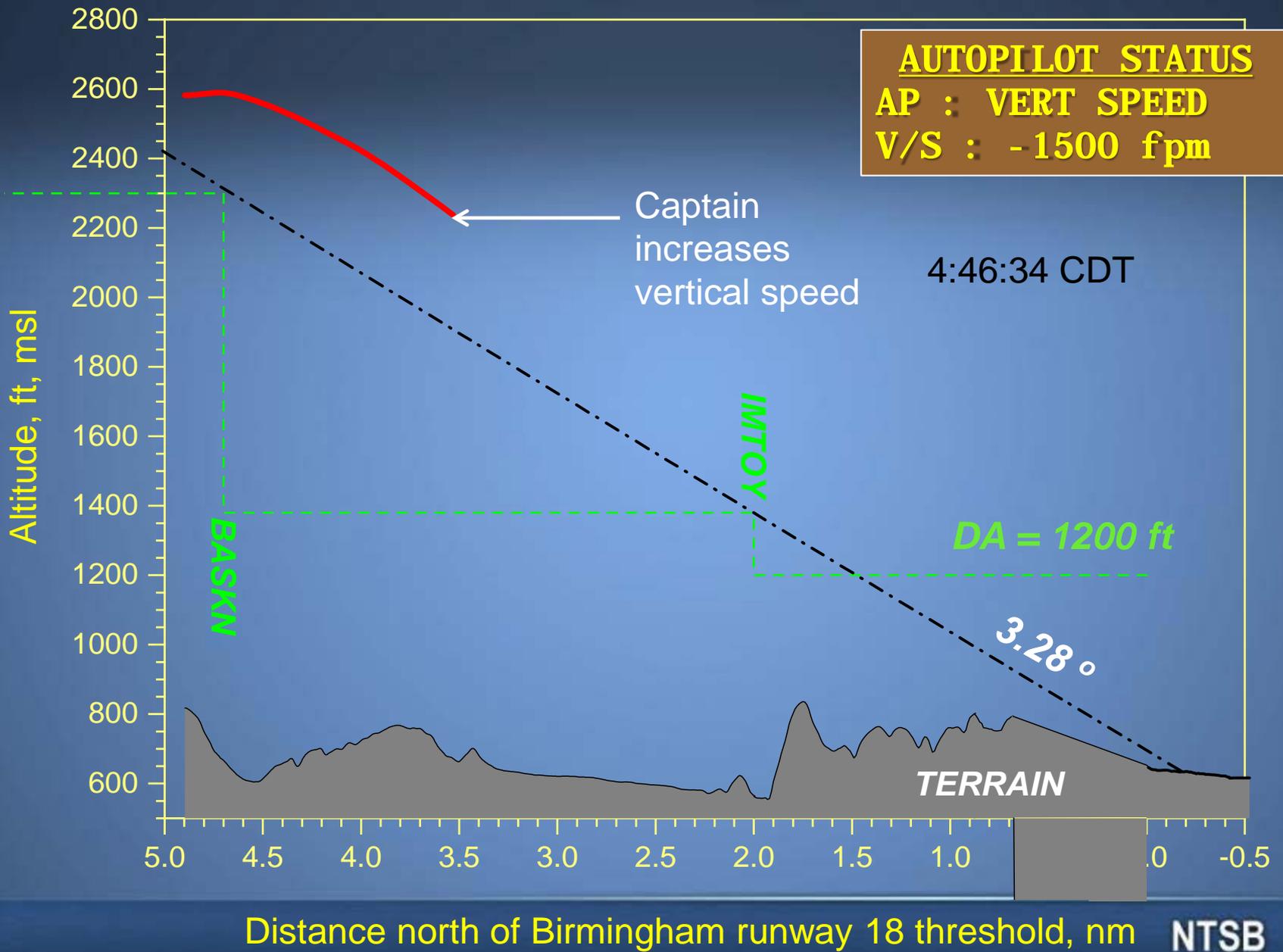


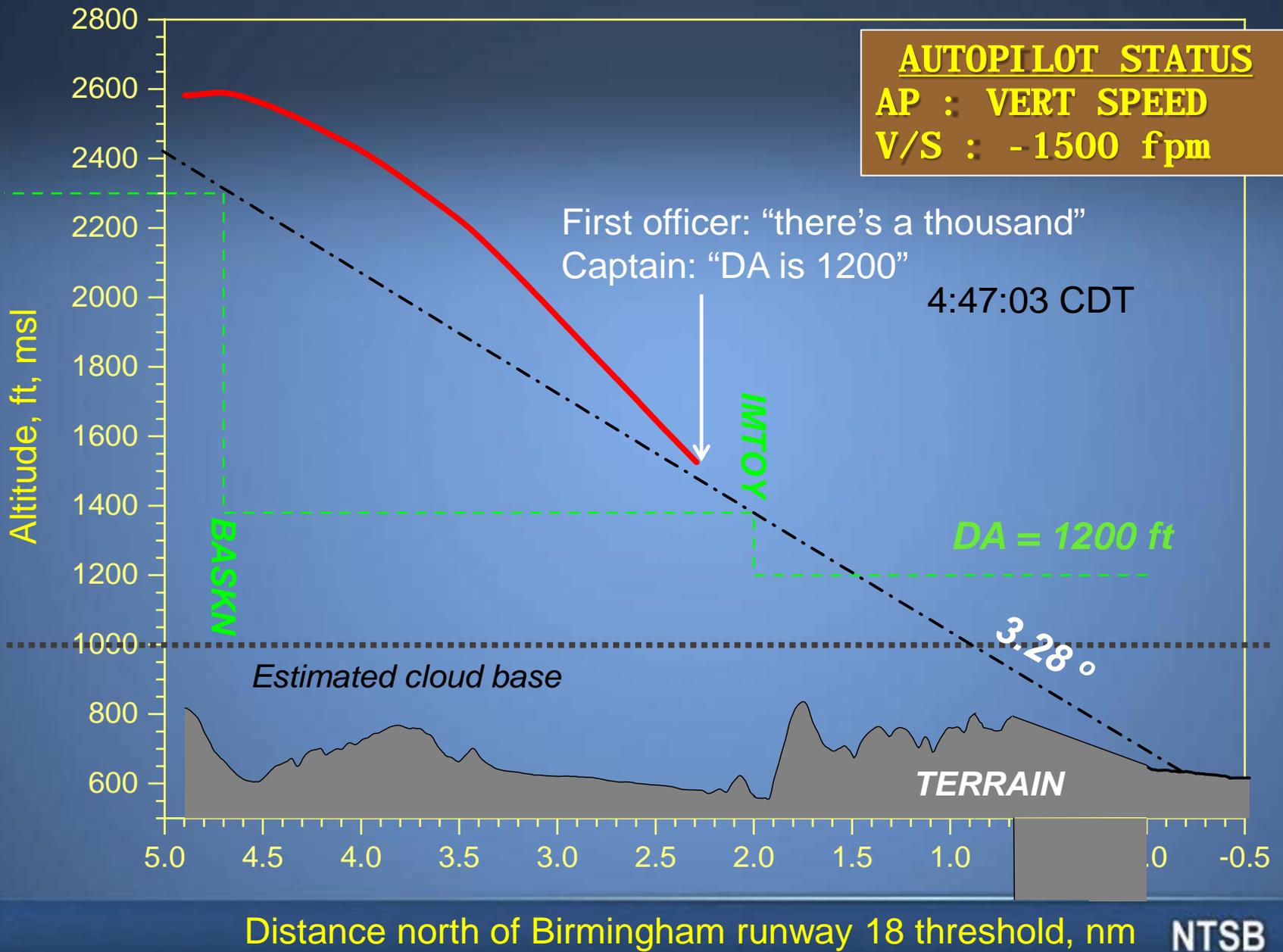


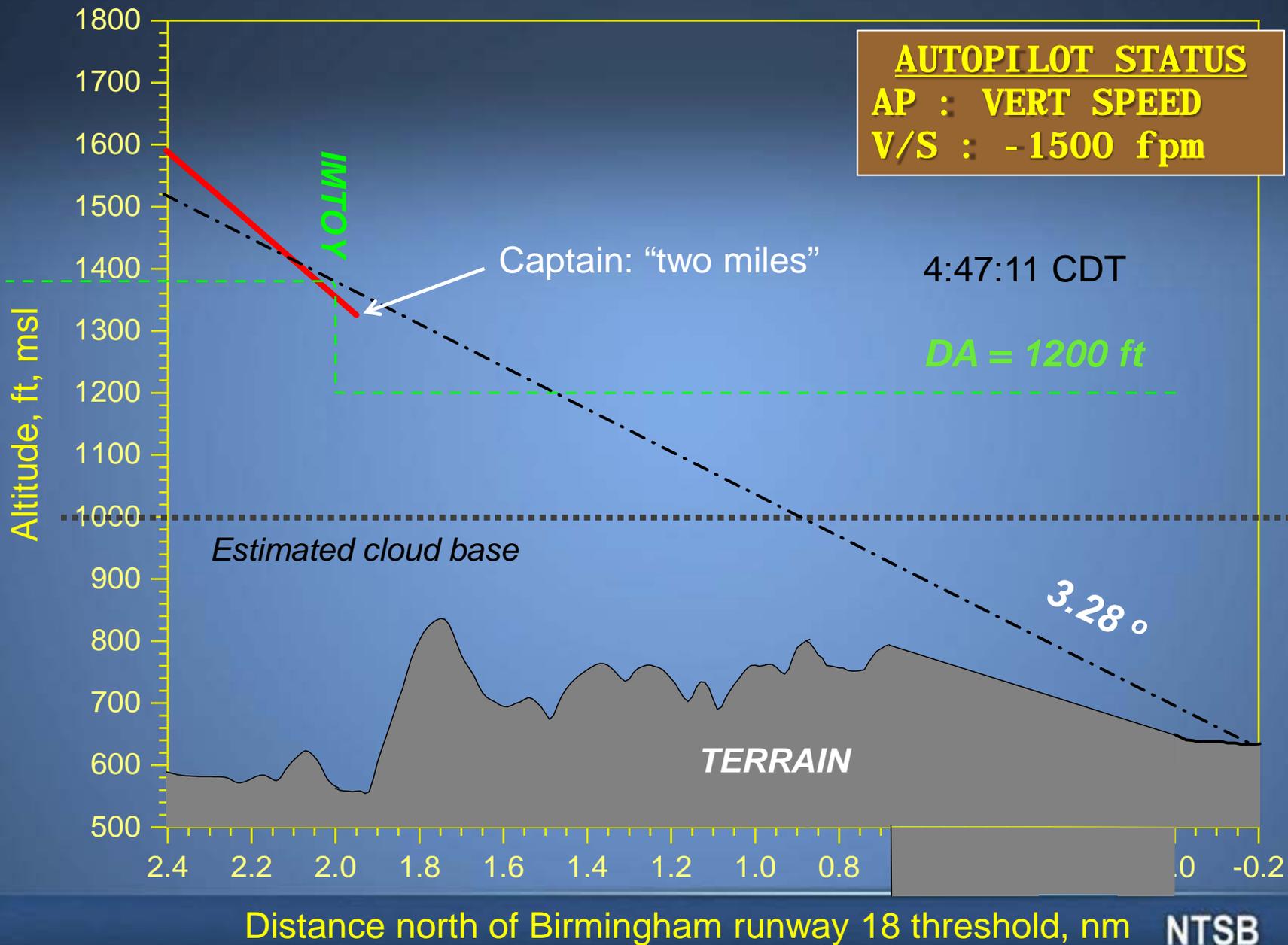
Distance north of Birmingham runway 18 threshold, nm **NTSB**

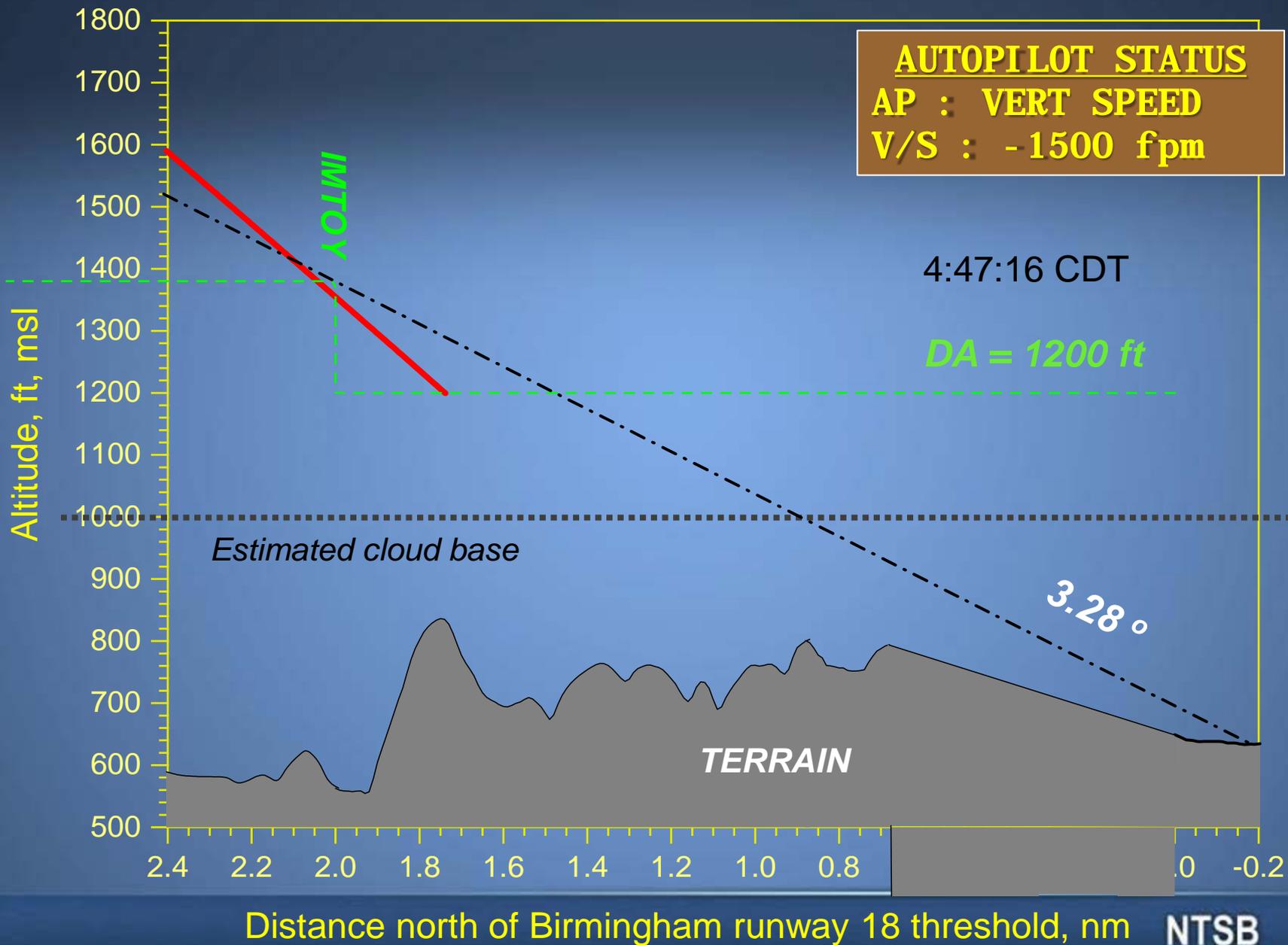


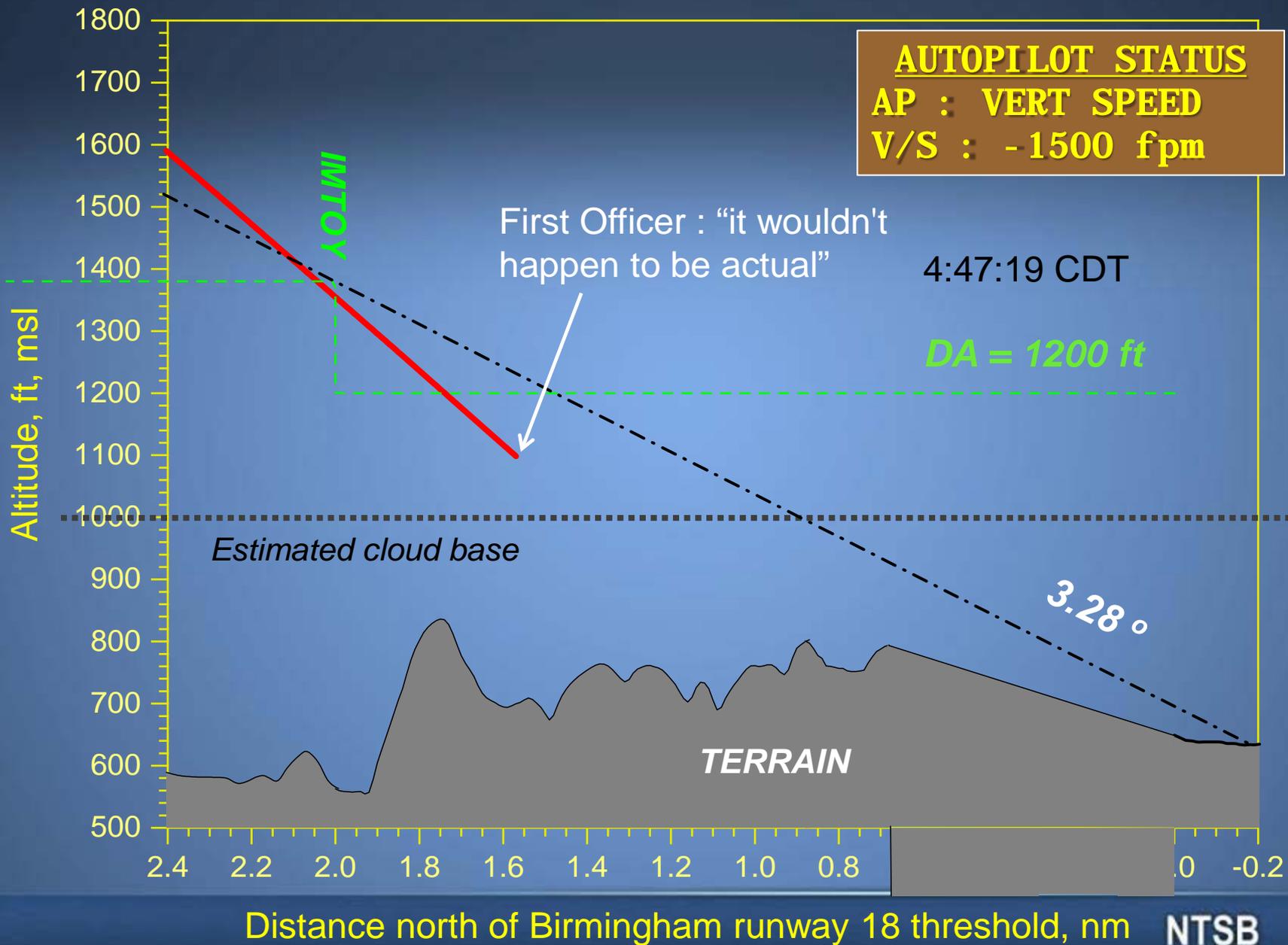


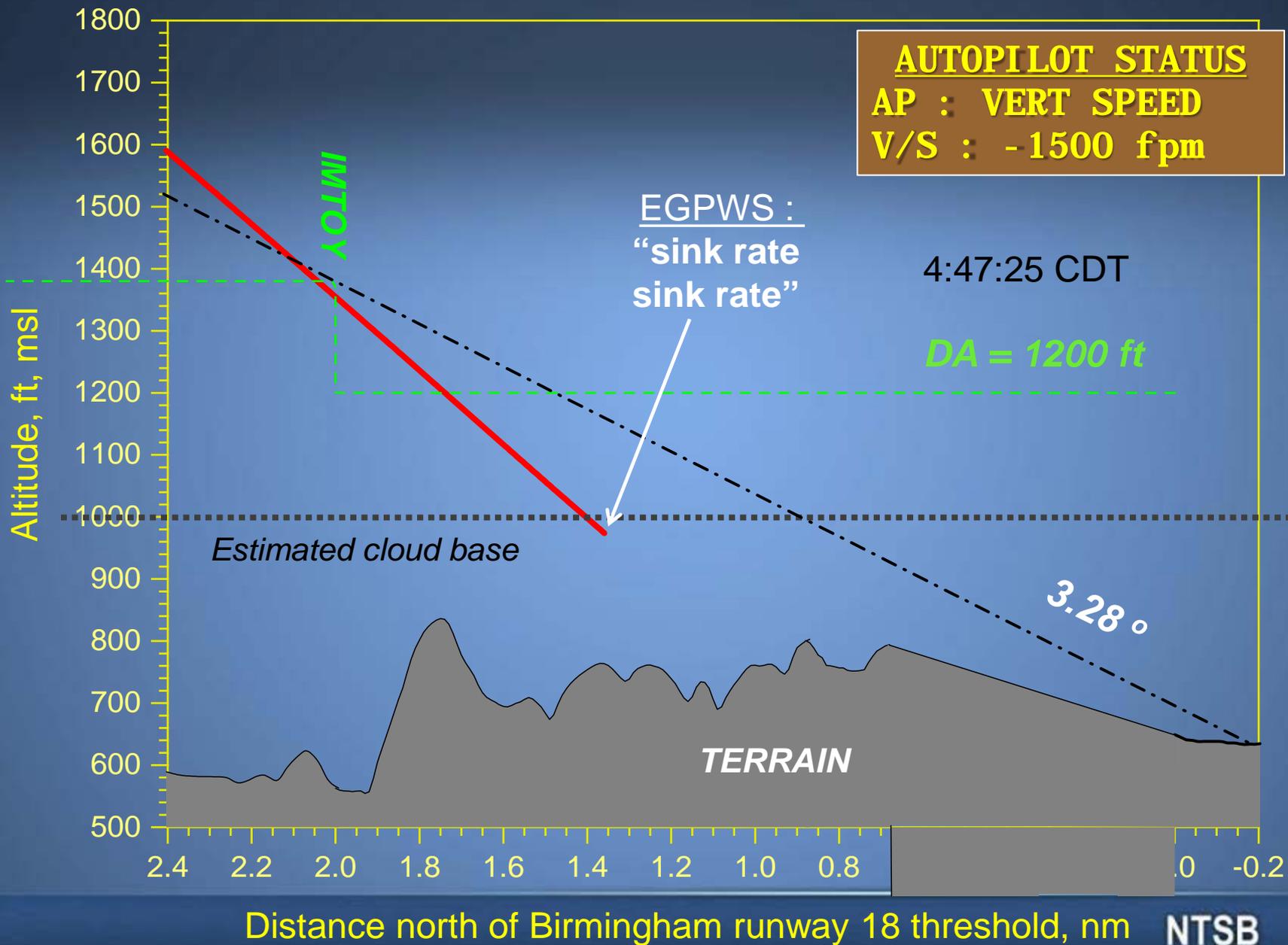


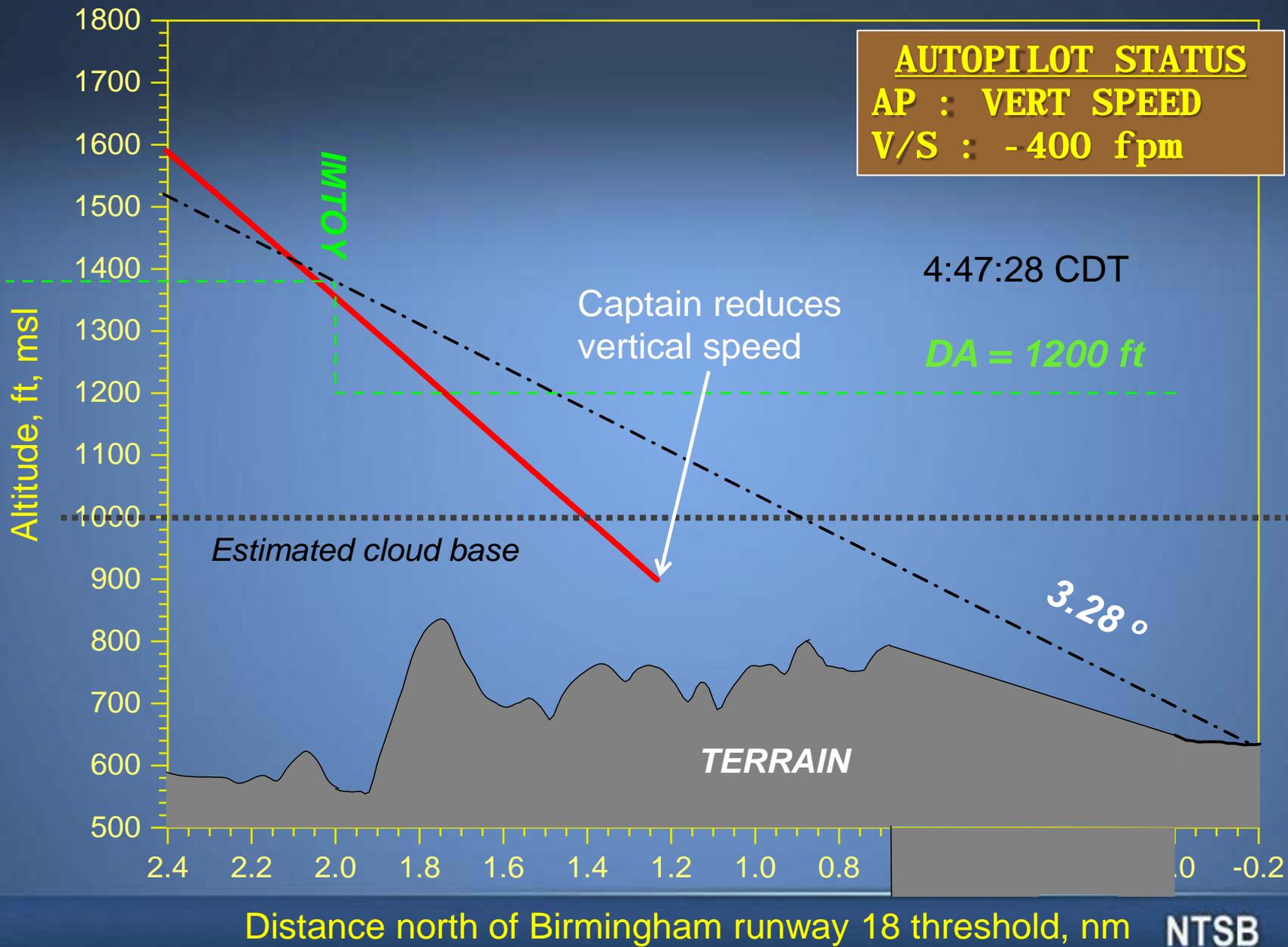


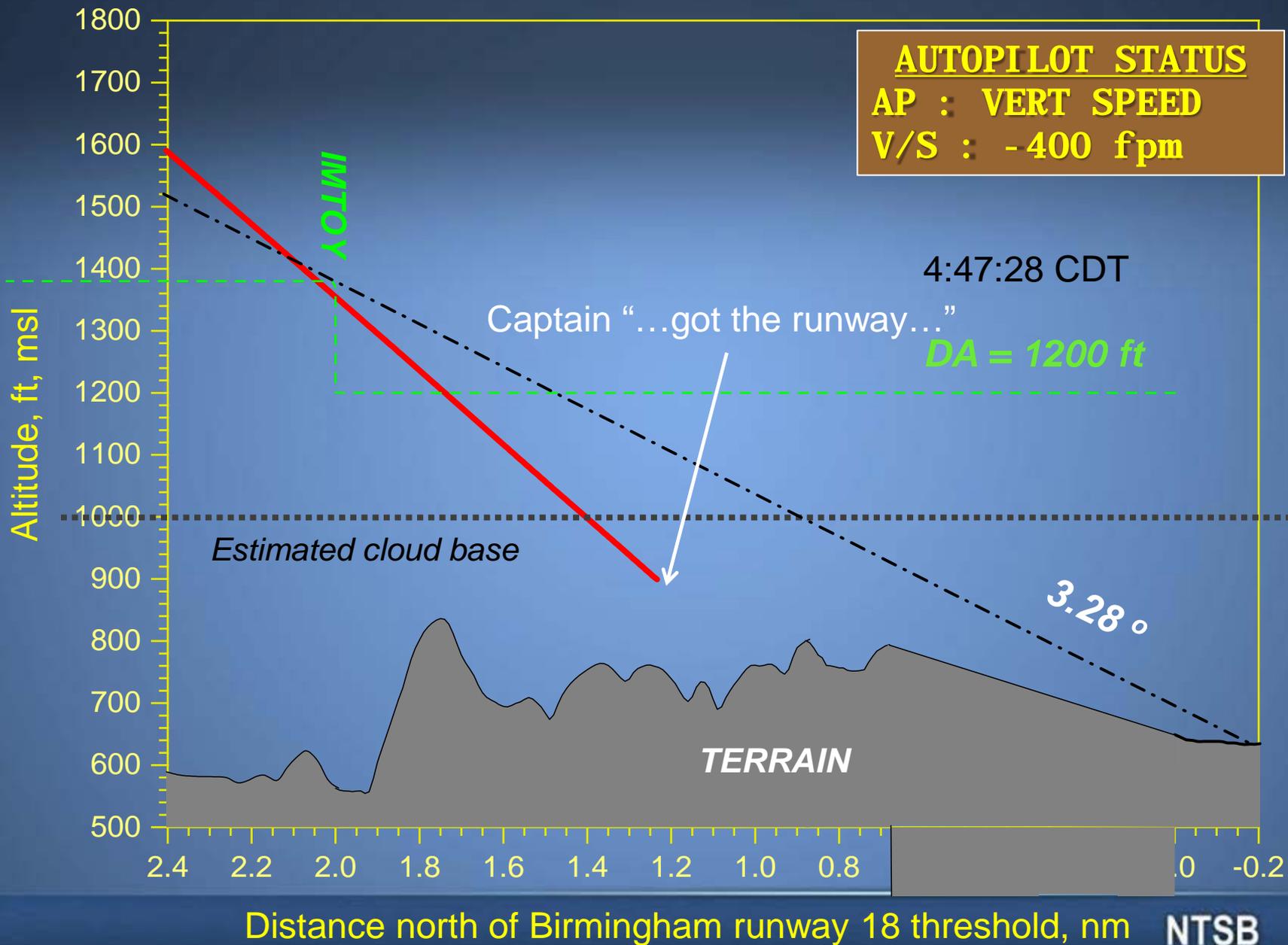


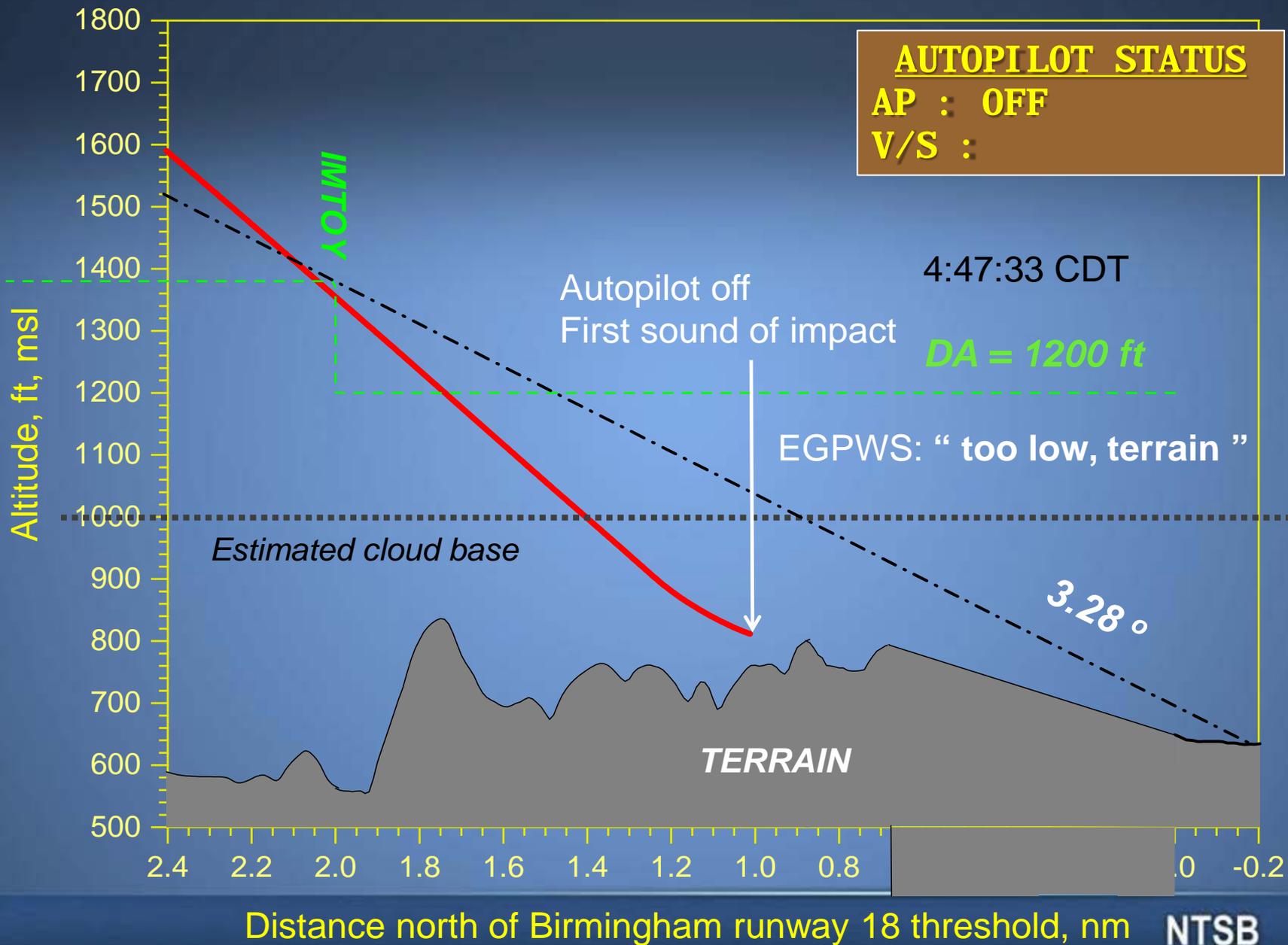














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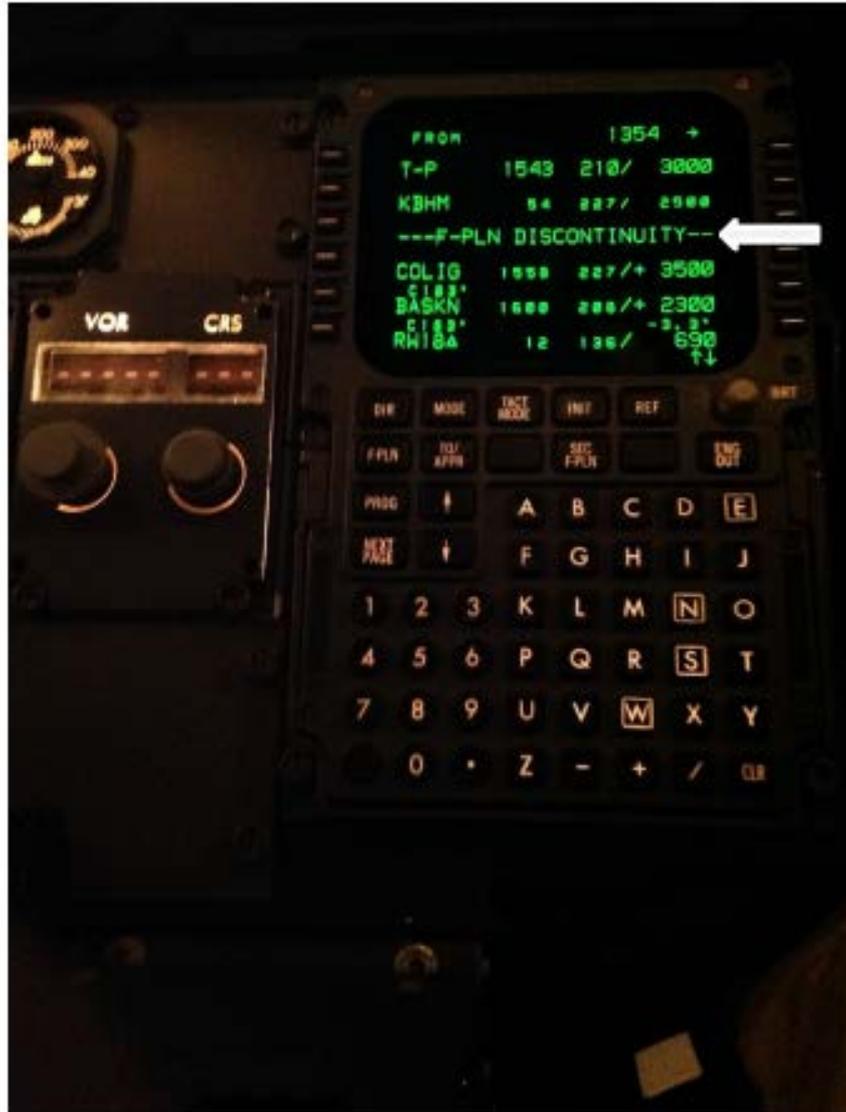
NTSB

Two critical errors

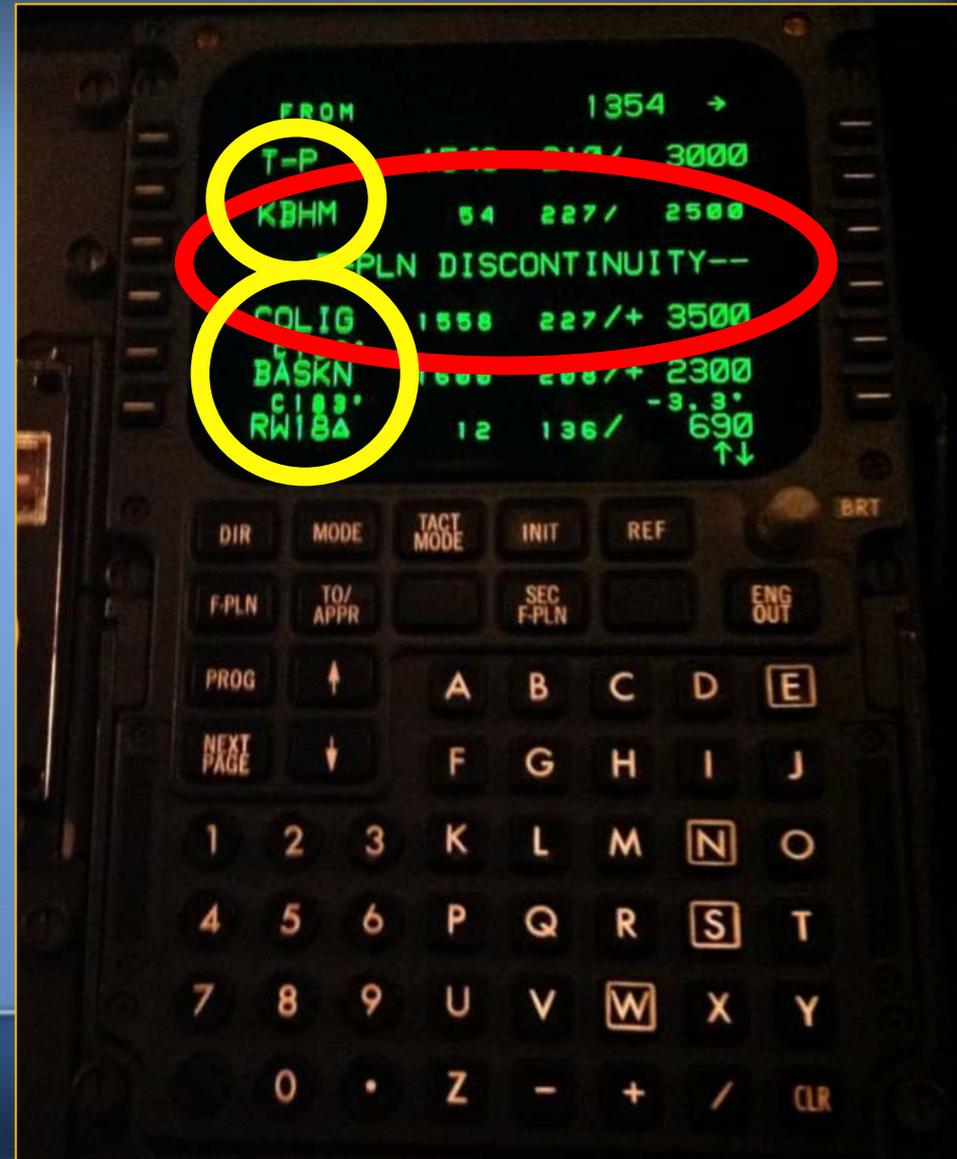
- Not sequencing the FMS flight plan
- Not monitoring



Not sequencing the flight plan



Approach Setup



Navigation Display



The distraction

- F/O: “I don’t think we have many choices if runway 6 is closed” [laughter]
- Captain: “Ahhh [laughter] I know. What else can we do” [laughing].
- F/O: “I’m like, ahhh, well, what else ahh you gonna – unroll another one out there for us real quick or whatever” [chucking]
- Captain: “It’s like, okay, yeah, you got another... yeah you got an ILS on some’m else?” [chuckling]
- F/O: “Uhh... I know” [chuckling]



During the Approach

Captain

- Changed from previously briefed profile mode to vertical speed mode
- Did not verbalize his intentions to first officer
- Increased descent rate to 1,500 fpm

Approach Callouts

- First officer made 1,000-foot callout
- Descent rate exceeded stable approach criteria
- First officer did not make:
 - 500-foot callout
 - “Approaching minimums” callout
 - “Minimums” callout
- TAWS low-altitude aural callouts (“smart callouts”) were not enabled by UPS

Workload: First Officer

- Had to mentally process change in autopilot mode
- No shared expectation of approach
- 1500-fpm descent twice as fast as normal descent rate
- Pace of duties increased

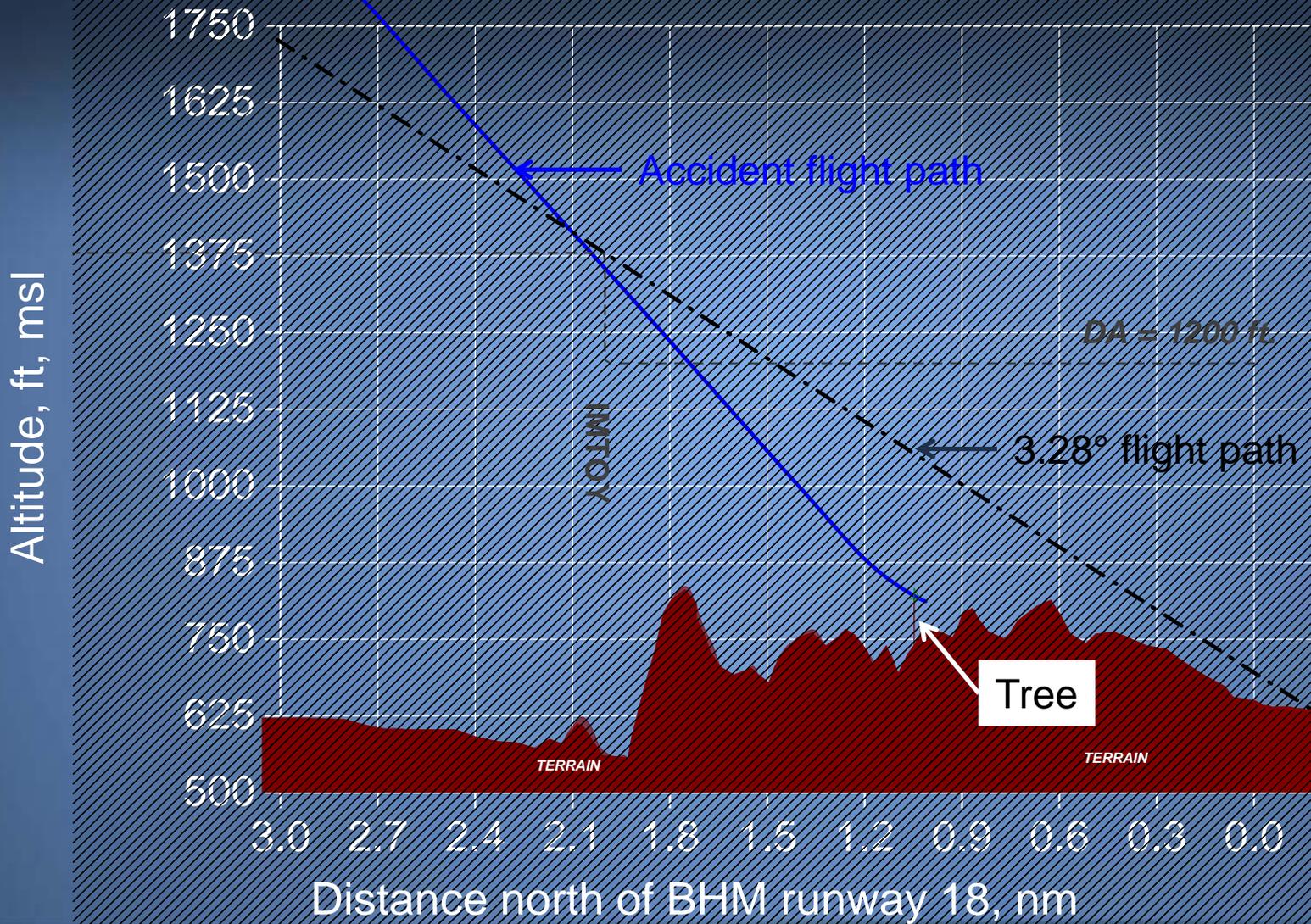


Expectancy

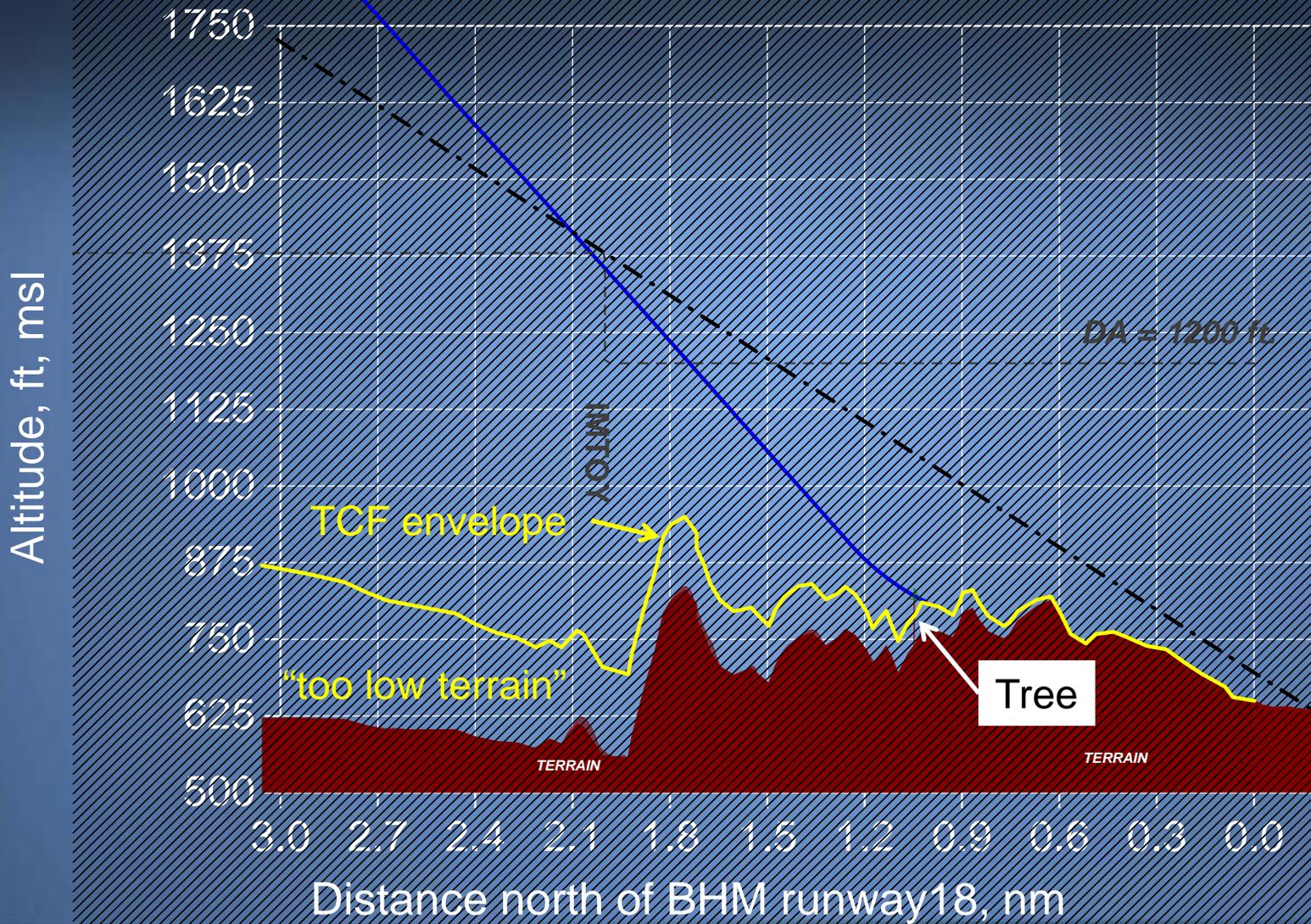
- They were high on the approach
- They would break out of the clouds at 1,000 agl.



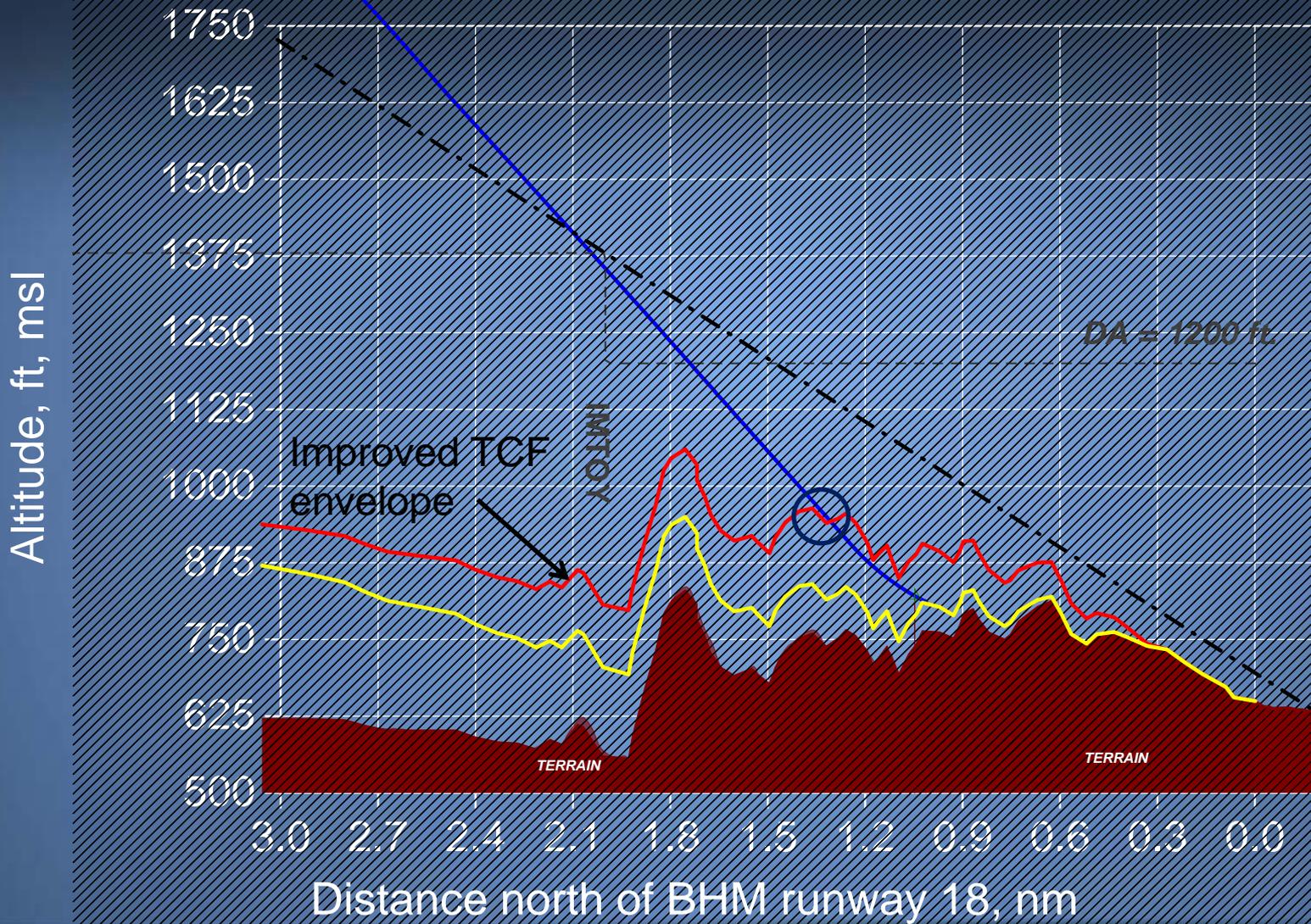
EGPWS Terrain Clearance Floor



EGPWS Terrain Clearance Floor



EGPWS Terrain Clearance Floor



NTSB Findings: TAWS

- Newer TAWS software would have provided a “too low terrain” caution alert 6.5 seconds sooner and 150 feet higher.
 - Because of the excessive descent rate and not knowing how aggressively the pilots would have responded, the effect on the accident could not be determined.
- An escalating series of TAWS alerts before impact with terrain or obstacles is not always guaranteed due to technological limitations, which reduces the safety effectiveness of the TAWS during the approach to landing.



NTSB Findings: “Smart Callouts”

- An automated “minimums” and/or altitude above terrain alert would have potentially provided the flight crewmembers with additional situational awareness upon their arrival at the MDA.
- In the absence of the automated “minimums” alert, an automated “500-ft” callout could have made the flight crewmembers aware of their proximity to the ground, and they could have taken action to arrest the descent.



NTSB Finding: Monitoring

“The flight crew did not sufficiently monitor the airplane’s altitude during the approach and subsequently allowed the airplane to descend below the minimum altitude without having the runway environment in sight.”



NTSB Finding: F/O's performance

“The first officer poorly managed her off-duty time by not acquiring sufficient sleep, and she did not call in fatigued; she was fatigued due to acute sleep loss and circadian factors, which, when combined with the time compression and the change in approach modes, likely resulted in the multiple errors she made during the flight.”



Probable Cause

The flight crew's continuation of an unstabilized approach and their failure to monitor the aircraft's altitude during the approach, which led to an inadvertent descent below the minimum approach altitude and subsequently into terrain.



Contributing to the accident

- (1) the flight crew's failure to properly configure and verify the FMS for the profile approach;
- (2) the captain's failure to communicate his intentions to the first officer once it became apparent the vertical profile was not captured;
- (3) the flight crew's expectation that they would break out of the clouds at 1,000 feet above ground level due to incomplete weather information;



Contributing to the accident

(4) the first officer's failure to make the required minimums callouts;

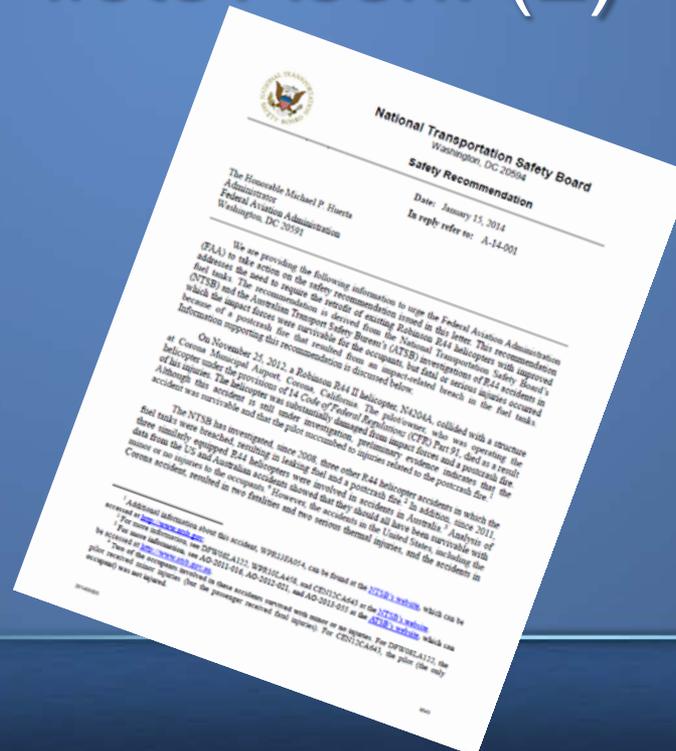
(5) the captain's performance deficiencies likely due to factors including, but not limited to, fatigue, distraction, or confusion, consistent with performance deficiencies exhibited during training; and

(6) the first officer's fatigue due to acute sleep loss resulting from her ineffective off-duty time management and circadian factors.



20 Recommendations

- FAA (15)
- Independent Pilots Assn. (2)
- UPS (2)
- Airbus (1)



Recommendation to FAA

- Prohibit “dive and drive” approaches.



Recommendation to FAA

- Advise operators that, in certain situations, an escalating series of TAWS warnings may not occur before impact with terrain or obstacles.
- Encourage operators to review their procedures for responding to alerts on final approach to ensure that these procedures are sufficient to enable pilots to avoid impact with terrain or obstacles in such situations.



Recommendation to FAA

- Require all operators of airplanes equipped with the automated “minimums” alert to activate it, and to activate the TAWS 500-ft voice callout or similar alert.





Common Threads



- Neither approach was stabilized
- Neither had effective monitoring
- Neither had effective intra-cockpit communications
- ILS was unavailable in both cases
- Fatigue



Take Away Slide

The Crashes of Asiana and UPS

Learn...

- ➔ Nothing good comes out of an unstabilized approach
- ➔ Monitoring of the flight path is critical

Apply...

- ➔ Ensure your operation has stabilized approach criteria.
- ➔ Go around if approach is not stabilized.
- ➔ Monitor the flight instruments!

Share...

- ➔ Share this message with those that you fly with and your co-workers.



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