

Factual Report – Attachment 22
Atlas CRM Training Presentation

OPERATIONAL FACTORS

DCA19MA086

What We Knew



Delta is an air line run by professionals.
Like Russ Worth.

Russ made his first airline flight over 22 years ago. Since that time, he has flown the DC-4, the DC-6, the DC-8 and the DC-9 jet. Now he's a Delta 727 Captain with over 15,000 hours and 6 million miles under his seat belt.

Russ Worth is a Captain you can count on. And Delta has over a thousand more like him. Delta is ready when you are.



The new 727 will fly faster than the 707, and it's the only jet in the world that can fly in the sky and on the ground.



What We Knew (circa 1970's)



The Revolution/Evolution Begins...



Behavioral Markers

CRM ENVIRONMENT (Mindset)	
• Leadership / Followership • Interpersonal Relationships • Communication • Decision-Making	• Assertiveness • Inquiry / Advocacy • Vigilance • Crew Self-Critique

TEM CYCLE / BEHAVIORAL MARKERS (Toolset / Skillset)		
Planning	Execution	Active Review
• Brief / State Plans • Define Roles / Assign Tasks • Identify Threats • Consider Contingencies	• Monitor / Crosscheck - Flight Path, Systems, Crew • Manage Workload • Manage Automation	• Evaluate / Modify Plans • State Concerns • Challenge Assumptions • Debrief / Give Feedback



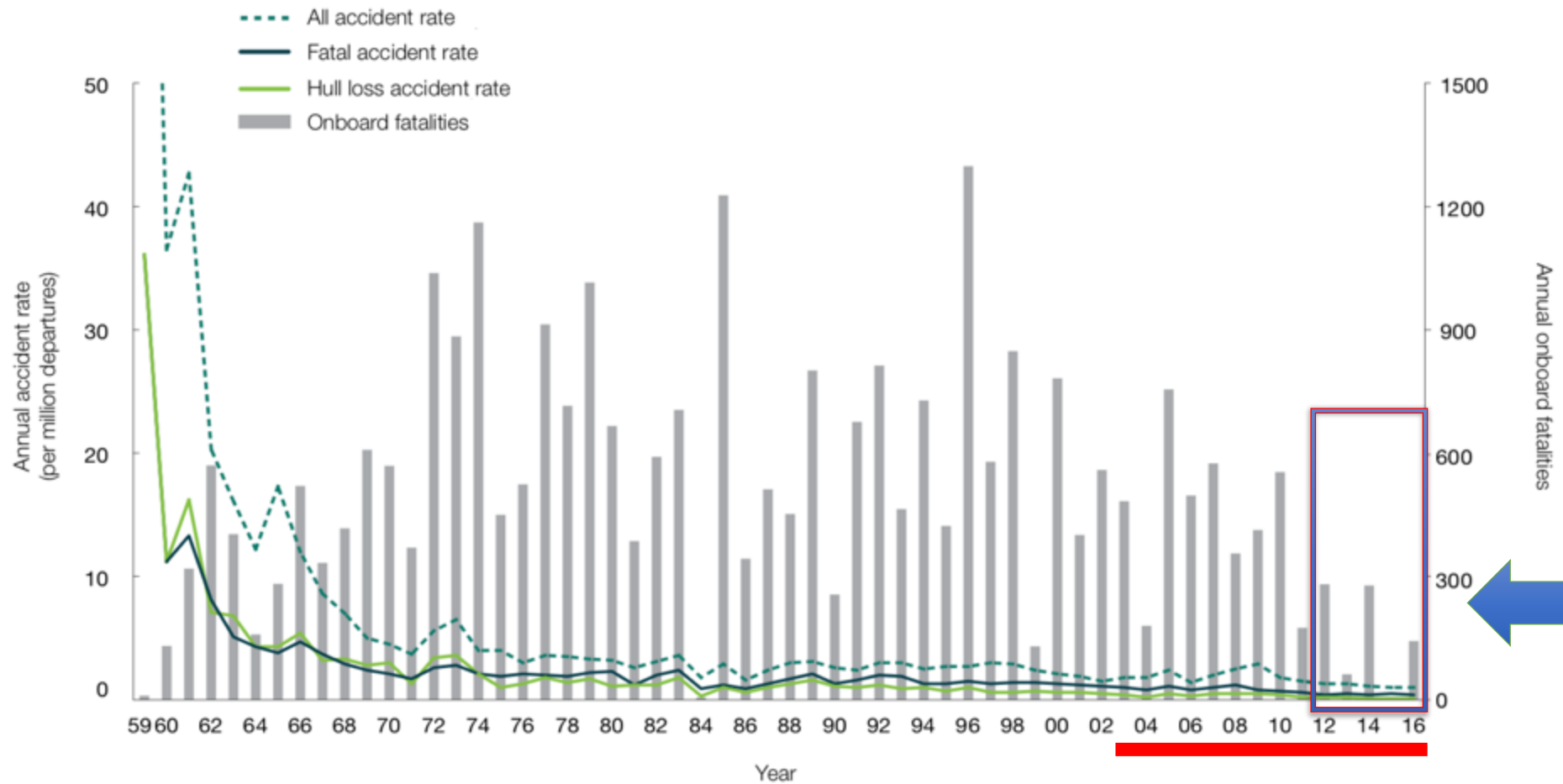
Through the Years



The Boeing Study

Accident Rates and Onboard Fatalities by Year

Worldwide Commercial Jet Fleet | 1959 through 2016



Effective Communication



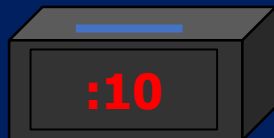
Barrier to Effective Communication



The departure weather is IMC. The PF briefs the AeroData engine out procedure. Wary of its' reliability, the CA says "actually, if we lose an engine, clean up to flaps 10 only, and make the turn to the right since the "pink page" always had us go that way in the past..." This is proper use of PIC authority and the sound ADM

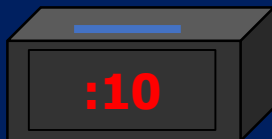
A. Yes

B. No



How should the PF handle the situation?

- A. Get up and walk away
- B. Say “I’m not comfortable with this” and advocate that the SOP is to fly AeroData, as published
- C. Just go with it and keep the peace
- D. Threaten to call the chief pilot



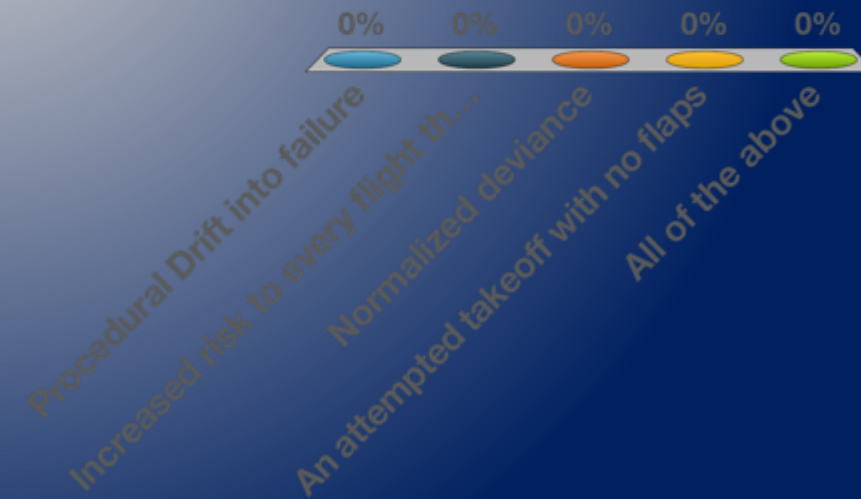
The PF calls for the before takeoff checklist. When the PF responds to the position of the flaps, the PM notices the PF is looking outside as he says the response, rather than inside at the proper locations. The PM should:

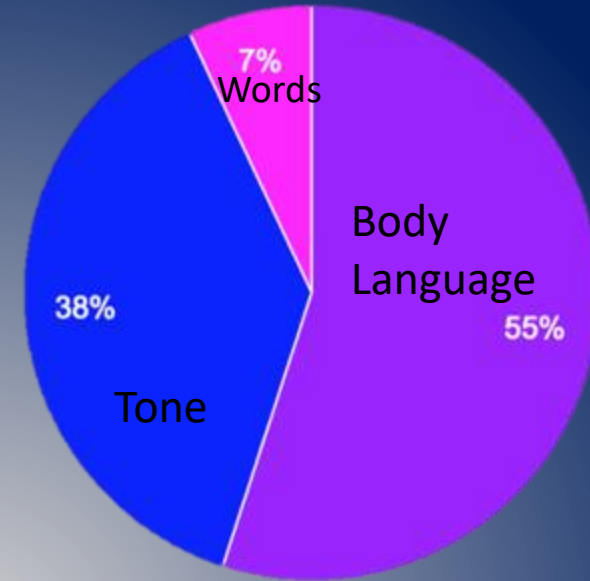
- A. Let it go
- B. Admonish the PF for being slack
- C. Pause until the PF does it right
- D. Address it later, but to crosscheck it properly as if he were the PF



If all PM's let this PF get away with this behavior; which could potentially occur?

- A. Procedural Drift into failure
- B. Increased risk to every flight they fly
- C. Normalized deviance
- D. An attempted takeoff with no flaps
- E. All of the above





"I didn't **SAY** you were stupid."
"I didn't say **YOU** were stupid."
"I didn't say you were **STUPID**."



NTSB MOST WANTED LIST

OF TRANSPORTATION SAFETY IMPROVEMENTS 2015

CRITICAL CHANGES NEEDED TO REDUCE TRANSPORTATION ACCIDENTS AND SAVE LIVES

STRENGTHEN PROCEDURAL COMPLIANCE



www.nts.gov/mostwanted



Boeing has described its philosophy as follows:

- *The pilot is the final authority for the operation of the airplane*
- *Both crew members are ultimately responsible for the safe conduct of the flight*
- *Flight crew tasks, in order of priority, are safety, passenger comfort, and efficiency*
- *Design for crew operations based on pilot's past training and operational experience*





- *Design systems to be error tolerant*
- *The hierarchy of design alternatives is simplicity, redundancy, and automation*
- *Apply automation as a tool to aid, not replace, the pilot*
- *Address fundamental human strengths, limitations, and individual differences for both normal and non-normal operations*
- *Use new technologies and functional capabilities only when: they result in clear and distinct operational or efficiency advantages, and*
- *There is no adverse effect to the human-machine interface*



Modern Design Philosophy



U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: ELECTRONIC FLIGHT DECK
DISPLAYS

Date: 6/21/07

AC No: 25-11A

Initiated by: ANM-111

This advisory circular (AC) provides guidance for showing compliance with certain requirements of Title 14, Code of Federal Regulations (CFR), part 25, for the design, installation, integration, and approval of electronic flight deck displays, components, and systems installed in transport category airplanes.

Signed by Ali Bahrami

Ali Bahrami
Manager, Transport Airplane Directorate
Aircraft Certification Service

Think of it this way:

If an amber annunciation is not addressed, the aircraft may be damaged.

If a red annunciation is not addressed, people may die.

What is one limitation of a binary system?

The aircraft tells us the condition, it's up to us to apply the context.



The Quiet/ Dark Philosophy

Quiet/dark design philosophy suggests information is not displayed until something goes wrong

But.....This is a design philosophy, not an operational philosophy

The Quiet/ Dark Philosophy

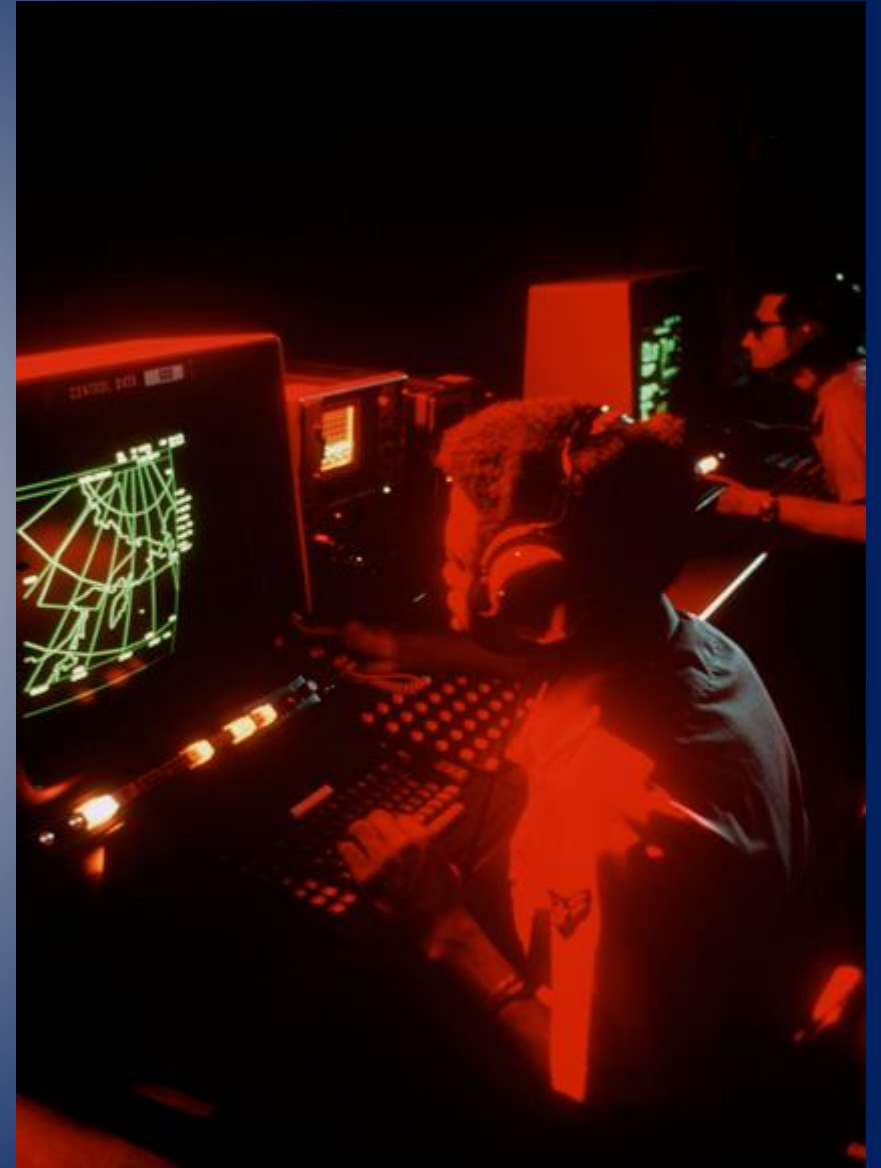


What would the airplane have told you by now?

What would you have needed to call out?



Humans & Monitoring

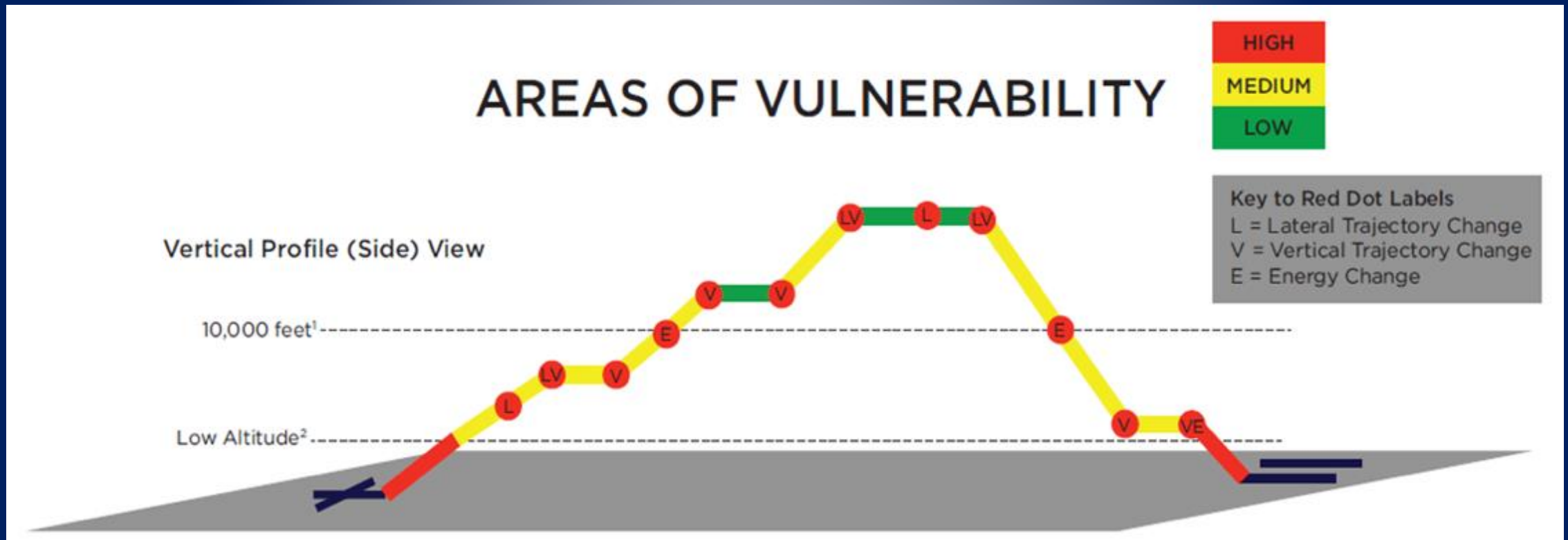


Monitoring

- *Present Day*



Flight Path Monitoring



Passive Monitoring VS Active Monitoring

- Looking at



- Looking for



NGFOM

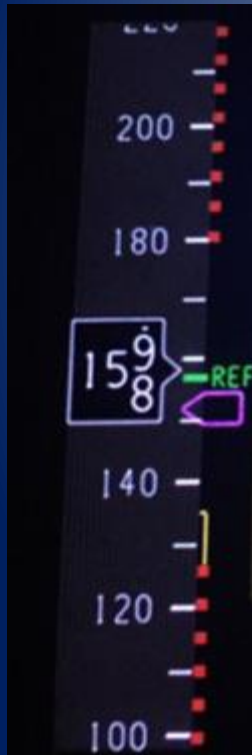
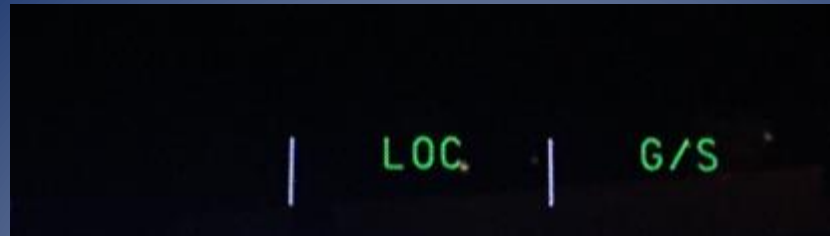


While some undesired aircraft states are somewhat unclear and may be debated, other undesired aircraft states are not subject to debate. Training exposes all pilots to these undesired aircraft states, which include:

- Unstabilized approaches
- Windshear
- Stall warning
- GPWS alerts
- TCAS RA

To aid in the recognition and recovery of these particular undesired aircraft states, defined recognition criteria and recovery procedures are published. These must be followed immediately and without question. Any time wasted in the decision making process may lead to an unrecoverable state.

Say When...



When



Immediate Windshear Alerting System

Immediate windshear alerts are provided when an excessive downdraft or tailwind is occurring during takeoff, approach, and landing. FCOM 15.20.25

2' RA



Full Rudder

Left aileron after, not before
pod strike

6.63 degrees of bank



Below ref= Reduced
control effectiveness

NWA 255

(1987)



The NTSB: "The probable cause of the accident was the flight crew's failure to use the taxi checklist to ensure the flaps and slats were extended for takeoff.

Contributing to the accident was the absence of electrical power to the airplane takeoff warning system, due to one of the pilots disconnecting a circuit breaker located in the flight deck, (the investigation was unable to determine who specifically disconnected this circuit.)

DAL 1141

(1988)

Both the Captain and the First Officer both said they were "certain" that the FO had moved the lever that shifts the flaps into the correct position for takeoff, but both men admitted that they did not specifically recall doing it, and were relying instead on their belief that correct cockpit procedures were followed.

Human factors

1. Sterile Cockpit – A rule set by the FAA where there cannot be any conversations unless flight related, normally below 10,000ft. From the cockpit voice recorder of flight 1141, it shows that the pilots and a flight attendant were having casual conversations during this period, which might have distracted the pilot from the checks.
2. Cockpit discipline – The pilots did not adhere to the sterile cockpit rule and as a Captain, he failed to enforce it when required.
3. Complacency – The first officer failed to move and visually check that the flaps are in the takeoff setting of 15 degrees, and failure of the Captain to monitor and crosscheck.
4. Situational awareness and decision making – The time between the stick shaker warning and Captain calling out "Full power" was 19 seconds, which might suggest that there was poor situational awareness and decision making.



NGFOM

- *‘But we already have a no fault go around policy....’*

Go-Around

Any and all go-arounds are no-fault.

Regardless of the reason for a go-around, any flight crewmember can call for a Go-Around and the PF must honor/execute a go-around. If a mechanical problem/configuration warning caused the missed approach/go-around/rejected landing, make an Aircraft Log entry.

Regardless of the reason for the Go-Around, the submission of an ASAP is encouraged.

10.1.17

NGFOM

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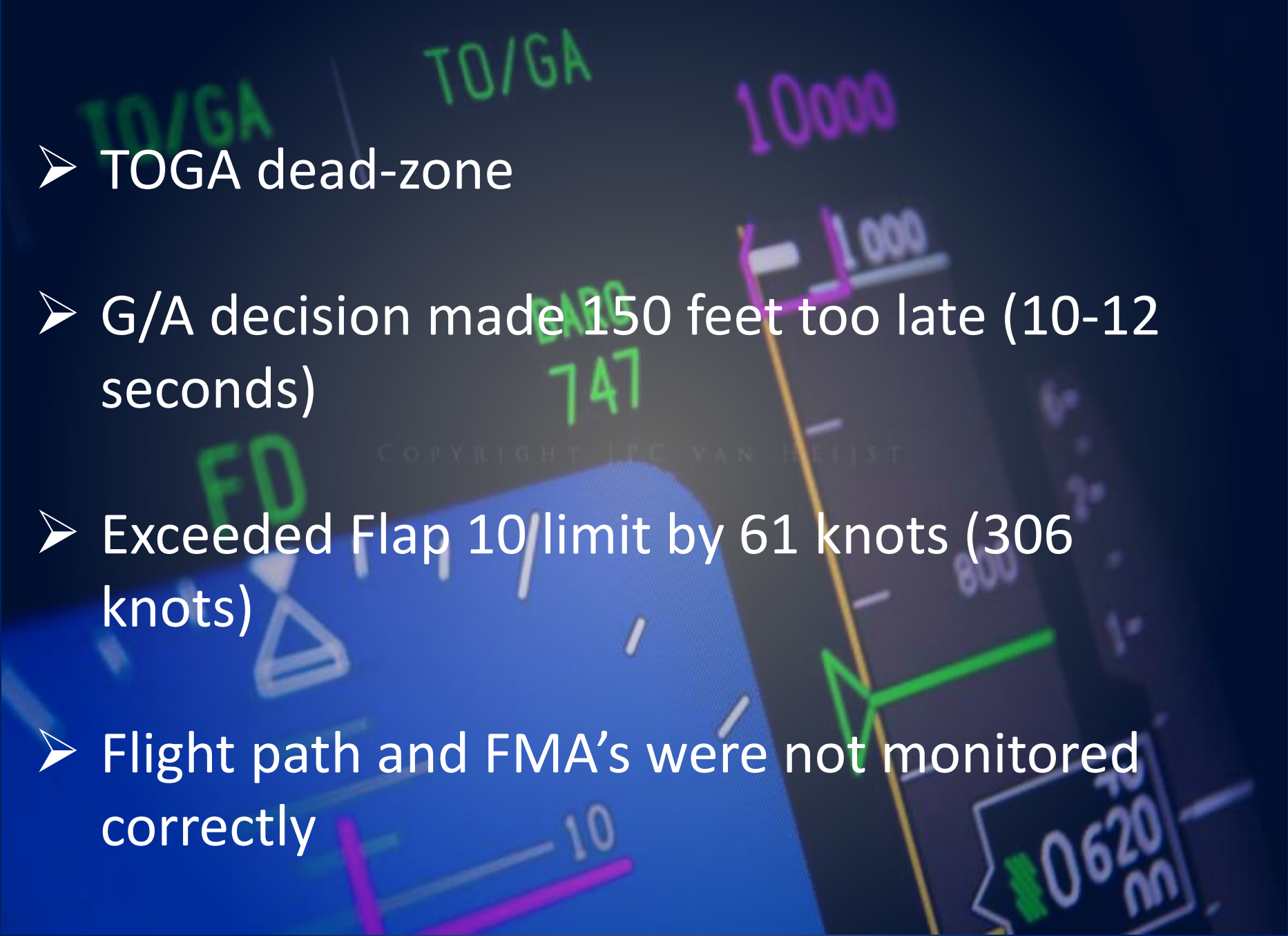
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- Windshear
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- TCAS RA

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11.1.10

Go Around Mode Awareness



- 
- The background of the slide is a blurred image of an aircraft's cockpit instrument panel. Visible elements include a vertical scale with markings for 10000 and 1000, a green digital readout showing '747', a green digital readout showing '0620 nm', and various other cockpit symbols and labels like 'TO/GA' and 'FD'.
- TOGA dead-zone
 - G/A decision made 150 feet too late (10-12 seconds)
 - Exceeded Flap 10 limit by 61 knots (306 knots)
 - Flight path and FMA's were not monitored correctly

For the safety and efficiency of any flight, communication is critical. This is not to say that effective communication can overcome inadequate technical flying proficiency, but rather the contrary, that good “stick and rudder” skills can not overcome the adverse effects of poor communication.

Sexton & Helmreich, 2000

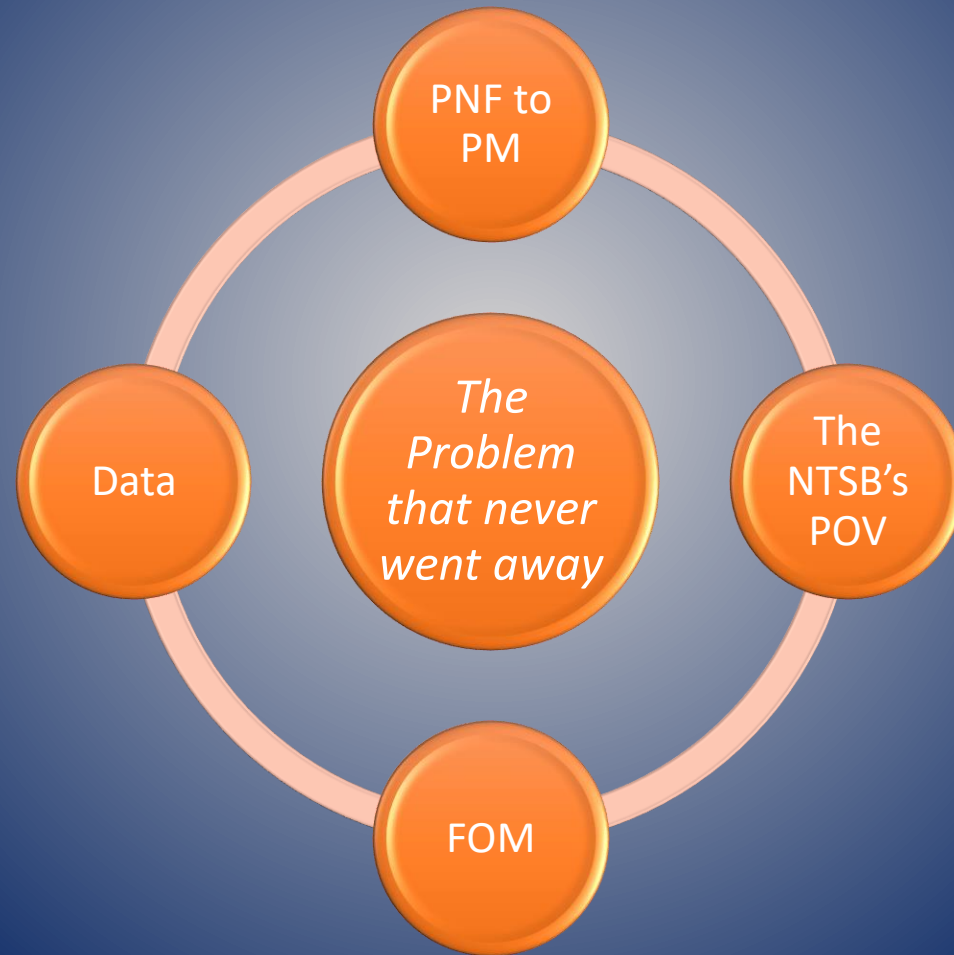
“Once you put pilots on automation, their manual abilities degrade and their flight path awareness is dulled: flying becomes a monitoring task, an abstraction on a screen, a mind numbing wait for the next hotel....”

Themselves?

William Langewiesche, Should the Aircraft be Flying



The Year of the Pilot Monitoring



PNF to PM



In 1994 safety study, NTSB found that ineffective flight path monitoring was a factor in 31 of the 37 (84%) of the reviewed crew-involved air carrier accidents.

Since that study, this researcher identified at least 11 additional high-profile accidents where ineffective flight path monitoring was cited by investigative authorities.

Did our problems go away?

NTSB Recommends/ FAA Enforces



U.S. Department
of Transportation
**Federal Aviation
Administration**

SAFO

Safety Alert for Operators

SAFO 15011
DATE: 11/17/15

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo

A SAFO contains important safety information and may include recommended action. SAFO content should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest. Besides the specific action recommended in a SAFO, an alternative action may be as effective in addressing the safety issue named in the SAFO.

Subject: Roles and Responsibilities for Pilot Flying (PF) and Pilot Monitoring (PM)

Purpose: This SAFO encourages operators to define roles and responsibilities for the PF and PM.

Discussion: Whether by inputs to autoflight systems or manually flying, controlling the flight path of the aircraft is the pilot's highest priority. In a two-pilot operation, one pilot is designated as PF and one pilot is designated as PM. Review of operators' manuals indicates that the roles and associated tasks of the PF and PM are not always clearly defined. Each operator should explicitly define the roles of the PF and PM to include:

1. At any point in time during the flight, one pilot is the PF and one pilot is the PM.
2. The PF is responsible for managing and the PM is responsible for monitoring the current and projected flight path and energy of the aircraft at all times.
3. The PF is always engaged in flying the aircraft (even when the aircraft is under autopilot control) and avoids tasks or activities that distract from that engagement. If the PF needs to engage in activities that would distract from aircraft control, the PF should transfer aircraft control to the other pilot, and then assume the PM role.
4. Transfer of PF and PM roles should be done positively with verbal assignment and verbal acceptance to include a short brief of aircraft state.
5. The PM supports the PF at all times, staying abreast of all air traffic control instructions and clearances and aircraft state.
6. The PM monitors the aircraft and system states, calls out any perceived or potential deviations from the intended flight path, and intervenes if necessary.

Operational policies and procedures should be reviewed or developed to ensure the division of duties and responsibilities between flightcrew members protects the ability of the PF to control the flight path. Assigning non-flight path-related tasks to the PF should generally be avoided. Operational data should be collected and used to revise definitions of PF and PM roles and responsibilities to ensure their effectiveness. Operators are encouraged to take an integrated approach in operations and training (initial/upgrade and recurrent) to emphasize the responsibilities and importance of PF and PM roles.

NGFOM

Pilot Roles

Pilot Flying

The Pilot Flying (PF) is the pilot who is tasked with manipulating the flight controls, either directly or through the aircraft's autoflight systems. The PF's primary task is to fly and navigate the aircraft in a manner consistent with safe operations and in accordance with the standards and instructions. The PF plans flight operations, ensures a shared mental model exists with all crewmembers, and then executes the plan.

Pilot Monitoring

The Pilot Monitoring (PM) is the pilot who is tasked with observing and commenting on the flight's progress. This PM's primary task is to 'quality check' the flight's operation by ensuring that the plan the PF has shared is in accordance with the standards and the briefing. Recognizing the inevitability of human error on the flight deck, the PM is expected to actively verify that the flight is proceeding according to the plan and alerts the PF if the flight deviates from the assumptions of that plan. In addition to the primary duty of flight path monitoring, the pilot monitoring conducts a series of support roles (i.e., running checklists, communicating over the radios, etc.). Because of the broad nature of the role, arguably, PM duties can be more difficult than PF duties.

Additional Flight Crewmember

The role of an additional flight crewmember is to actively monitor the PF, PM, aircraft flight path and energy, and assist in the safe conduct of the flight. The additional flight crewmember shall allow the operating crew the ability to comply with the prescribed policies in the FOM, and operate in accordance with the FCOM for that particular fleet. They shall do so without significant interruption or interference to the operating crew unless the additional flight crewmember determines a threat to the safety of the flight exists. An additional flight crewmember is also responsible for any applicable items delegated to them by the Captain. See *Augmented Flight Crews* on page 12.1.1.

What is the industry data telling us?

AA 1420
UPS 1354
AA 331
SWA 1455
SWA 1248
Garuda 200
GTI 4241



What is our data telling us?

Our normalization of deviance isn't as far removed as we would like to think....

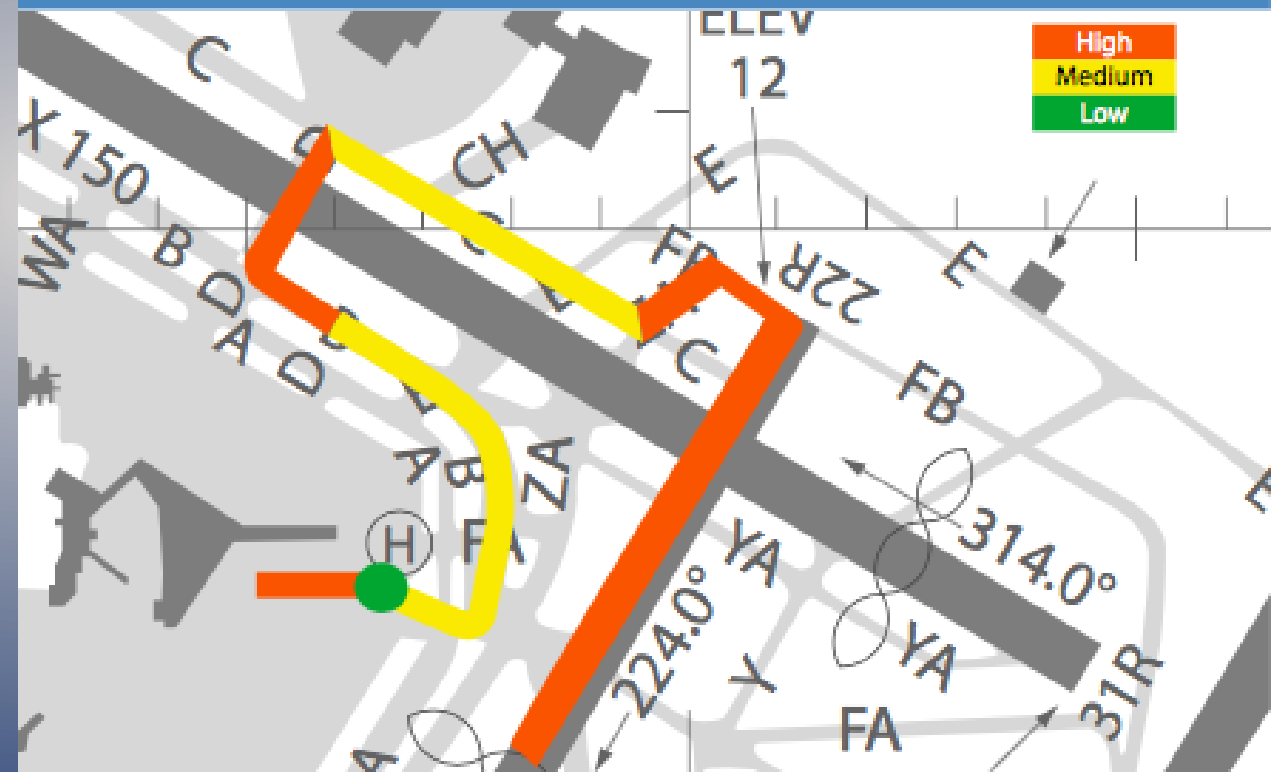


“Areas of Vulnerability” on the ground as well

Vulnerability During Flight Path Deviation

Flight Activity (Period)	Level of Vulnerability to a Path Deviation
Taxiing near or crossing a runway	High
Stopped on a taxiway with brakes set	Low
Straight-and-level cruise flight above 10,000 ft	Low
Final approach	High
Climbs and descents	Medium
Within 1,000 ft of level-off while climbing or descending	High
Initiating a course change	High
Initiating a speed change	High
Initiating an altitude change	High
Flight below 10,000 ft (if not already in a high-vulnerability activity/period)	Medium

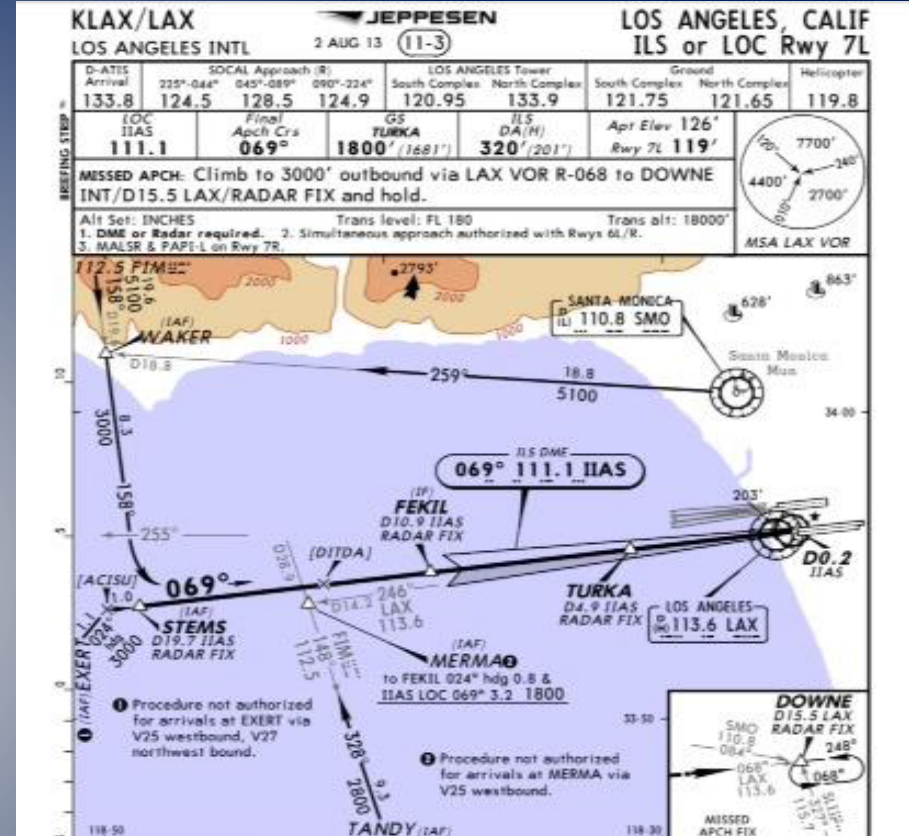
Areas of Vulnerability (AOV) to Flight Path Deviation, Ground Profile Examples



Instructor Comments

- *ILS 7L, G/S Out of service, the aircraft was given normal base to final vectors just inside FEKIL to include reasonable speed and altitude clearances.*
- *Upon intercepting the localizer the PF forgot to command the aircraft down to 1800 feet and left it at 3,000 feet. The PM never caught it.*
- *Inbound and cleared for the approach .4 prior to TURKA, with FEKIL still showing as the active way point and still @ 3,000 feet, the PF realized that he had not started down, and selected V/S -1200 FPM to try to catch up to the intended path. Additionally, he called for the landing gear to be lowered and the flaps to be selected to 30.*
- *Predictably, the configuration changes affected the airplanes ability to congruently slow down and go down. Noticing that the aircraft was not catching up to the desired path, nearing 1.5 miles from the runway passing 1300 feet, the PF increased the descent to -2000 fpm to which the PM said "You got this".*

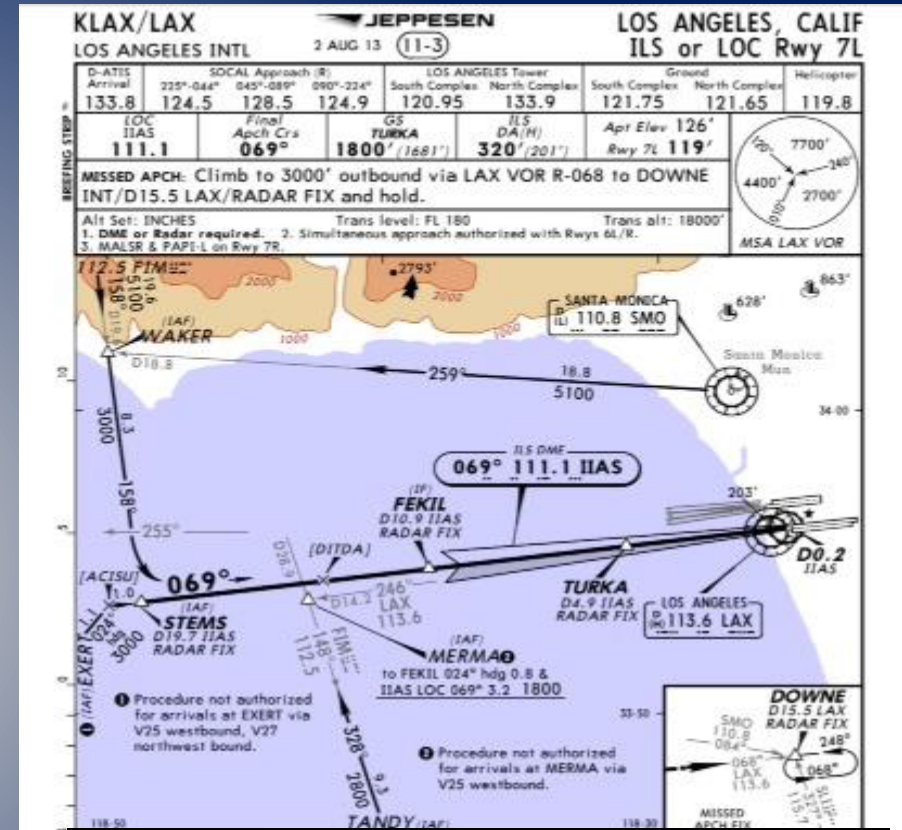
Los Angeles ILS 7L



Instructor Comments

- With the aircraft configured with flaps 30, and the gear down, (the thrust levers were at idle as the speed was still reducing back to 141 knots), the airplane was descending at -2000 fpm passing 1,000 feet AGL (MSL as well).
- At 800 feet, the aircraft broke out of the clouds and four red PAPI lights were visible. The PM said “runway in sight” and the PF said “roger” Still no vertical path correction was made.
- “Too low terrain” then sounded and the PF then disconnected the auto pilot and auto throttles manually leveling the airplane for a brief moment, before “Too Low Terrain sounded once again”.
- The PM then said “You still got this You still got this” and the PF responded with “I’m going around ok?”....
- After a slight hesitation he called for go around flaps 20. The PM did not call Positive Climb nor did he get the gear up until leaving 1,300 feet climbing to 3,000 feet. There was silence during the go around.

Los Angeles ILS 7L



Does this sound familiar?





NTSB

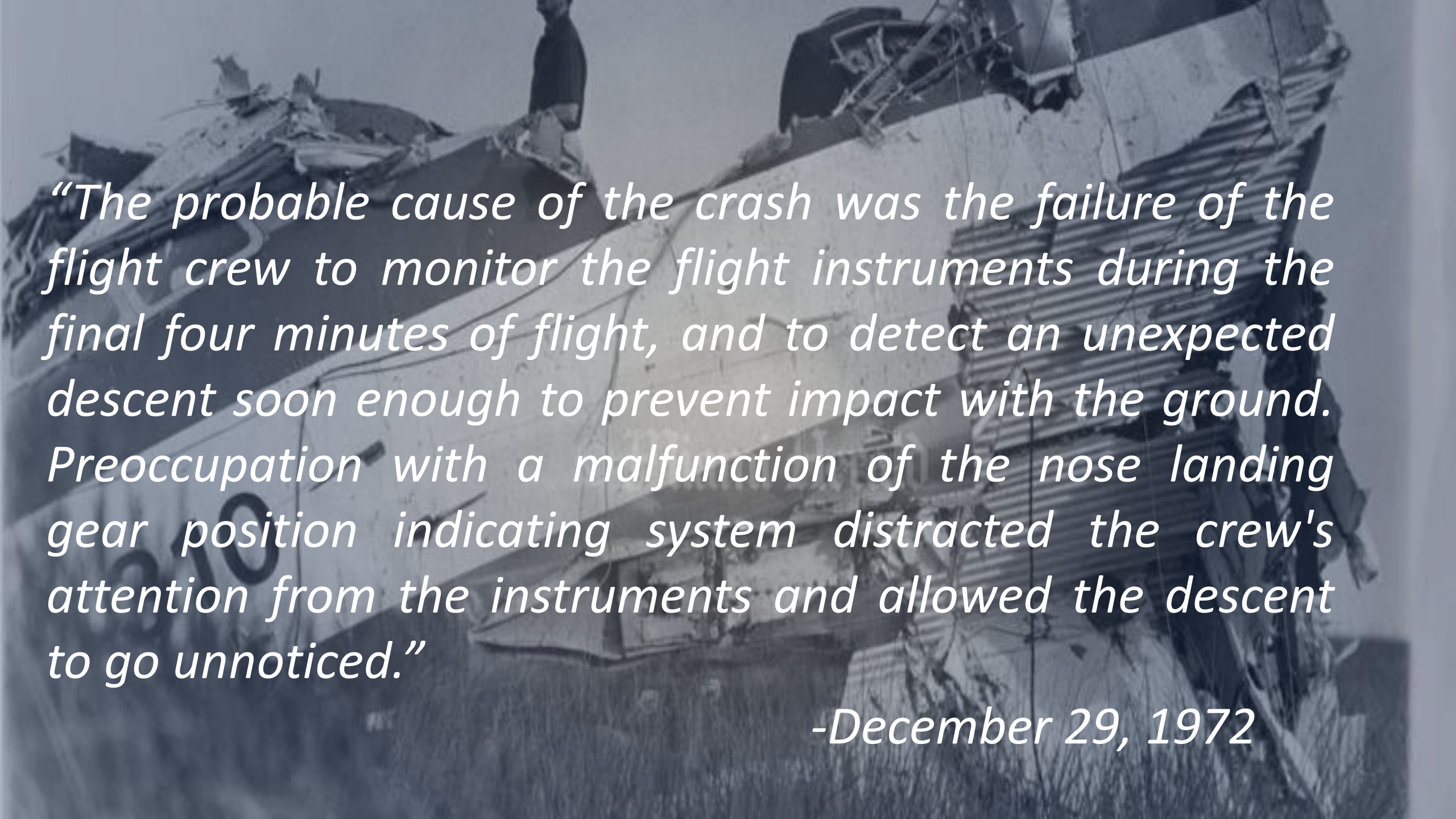
2017-2018
MWL
MOST WANTED LIST

Eliminate Distractions



It Can Wait-Distractions

<https://www.youtube.com/watch?v=8crvXJJNxbQ>



“The probable cause of the crash was the failure of the flight crew to monitor the flight instruments during the final four minutes of flight, and to detect an unexpected descent soon enough to prevent impact with the ground. Preoccupation with a malfunction of the nose landing gear position indicating system distracted the crew's attention from the instruments and allowed the descent to go unnoticed.”

-December 29, 1972

That moment you lower the music
when looking for the street address so
you can see better ...



The Great Multitasking Lie

DEBUNKING THE MYTHS OF CELL PHONE DISTRACTED DRIVING



Myth vs. Reality



Myth #1 Drivers can multitask.

Reality

Contrary to popular belief, the human brain cannot multitask. Driving and talking on a cell phone are two thinking tasks that involve many areas of the brain. Instead of processing both simultaneously, the brain rapidly switches between two cognitive activities.

Take the classic example of the act of walking and chewing gum. There is a common misconception that because people appear to simultaneously do both that they can just as easily talk on their cell phones and drive safely at the same time.



The truth is that walking and chewing gum involve a **thinking** task and a **non-thinking** task.



Conversation and driving are **both thinking** tasks.

Myth #2 Talking to someone on a cell phone is no different than talking to someone in the car.

Reality

A 2008 study cited by the University of Utah found that drivers distracted by cell phones are **more oblivious** to changing traffic conditions because they are the only ones in the conversation who are aware of the road.



In contrast, drivers with adult passengers in their cars have an **extra set of eyes and ears** to help keep the drivers alert of oncoming traffic problems. Adult passengers also tend to adjust their talking when traffic is challenging. People on the other end of a driver's cell phone cannot do that.

DEBUNKING THE MYTHS OF CELL PHONE DISTRACTED DRIVING



Myth vs. Reality



Myth #3 Hands-free devices eliminate the danger of cell phone use during driving.

Reality

Whether handheld or hands-free, cell phone conversations while driving are risky because the distraction to the brain remains.

Activity in the parietal lobe, the area of the brain that processes movement of visual images and is important for safe driving, decreases by as much as **37%** when listening to language, according to a study by Carnegie Mellon University.

Driving alone



Driving with sentence listening



Drivers talking on cell phones can miss seeing up to 50% of their driving environments, including pedestrians and red lights. They look but they don't see. This phenomenon is also known as **"inattention blindness."**

Myth #4 Drivers talking on cell phones still have a quicker reaction time than those who are driving under the influence.

Reality

A controlled driving simulator study conducted by the University of Utah found that drivers using cell phones had **slower reaction times** than drivers with a .08 blood alcohol content, the legal intoxication limit.



There is a simple solution – drivers talking on cell phones can immediately eliminate their risk by **hanging up the phone**, while drunk drivers remain at risk until they sober up.

...I was hand flying the aircraft for proficiency. Our low gross weight produced very quick climb rate. The brand new co-pilot* was having trouble performing nearly all of the pilot monitoring duties. We were given an altitude clearance and as I began to capture the altitude, I was distracted by trying to assist the co-pilot* in his duties and overshot by several hundred feet.

* Co-pilot: A pre-1990's colloquialism for First Officer

...I counseled both FOs about how we must ensure comms are established and maintained at ALL times and the pitfalls of using CPDLC and checking to ensure we are with the proper en-route facility at each changeover. My sense is that they were both distracted by their conversation and just not paying attention. The flying pilot stated that he thought the other guy was doing his job. ...

...There was some confusion on the identifier (CCV) and how to amend the clearance to the airport and keep the selected approach in. I allowed myself to be distracted by this and failed to reset the MCP to the new altitude. Because of this, I forgot that we had a crossing restriction until ATC inquired if we would be able to "make it". I began an immediate descent and crossed the designated point approximately 2,000 feet high.







Interactive

- The briefing design should encourage interaction between the Pilot Flying (PF) and Pilot Monitoring (PM). It is time to put away the age-old notion of 'my leg, your leg'.
- Begin the briefing by asking the PM to review any relevant THREATS they might see. By requiring the PM to begin the discussion in this manner, a level of ownership and interactive engagement is fostered.
- The PM must take time to prepare an answer to the inevitable question that will start the briefing: *'What are our threats?'*
- Industry accident data continues to reveal that it is the PM that will play a significant role in noticing and re-establishing safety margins should they deteriorate.

Threat Forward

- Crew departure and arrival briefings should first address the relevant threats to the flight and go on to discuss specific countermeasures that could be employed should any of those threats degrade safety margins.

WHAT ARE OUR THREATS?		
Airport/Runway Contamination Construction Hotspots Adverse WX Visibility/Winds Precipitation Snow/Ice Environment Terrain Night Traffic Language barriers	ATC Clearance/Re-Routes Arrival/Departure Amendments Runway Changes Airline/Operations/Dispatch Schedule Pressure Delays Paperwork Airmen/Physiology Recency OE/Training Fatigue Onset, Stress Hydration, Nutrition	Aircraft Systems/MELs Automation Performance Ground/Ramp/MX Handling Congestion Logbook Cabin Passengers Interruptions