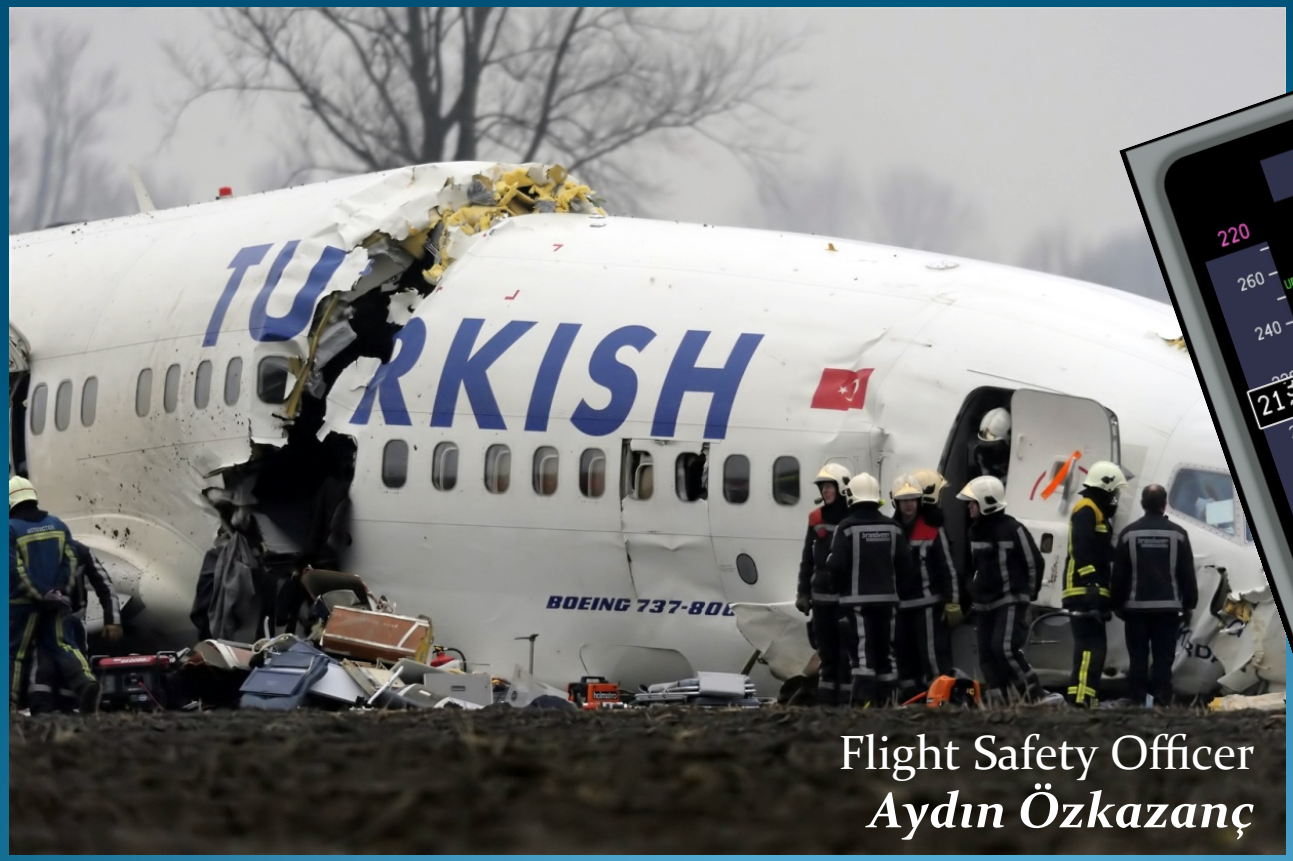
Automation Training and Situational Awareness



Flight Safety Officer
Aydın Özkazanç

FLIGHT SAFETY
THY

Loss of Control Workshop Salzburg, Austria 2012

- Thank you to Dr. Dieter and his team
- Message and best wishes from Turkish Airlines Flight Safety Department Manager and Colleagues

TURKISH AIRLINES

FLIGHT SAFETY THY

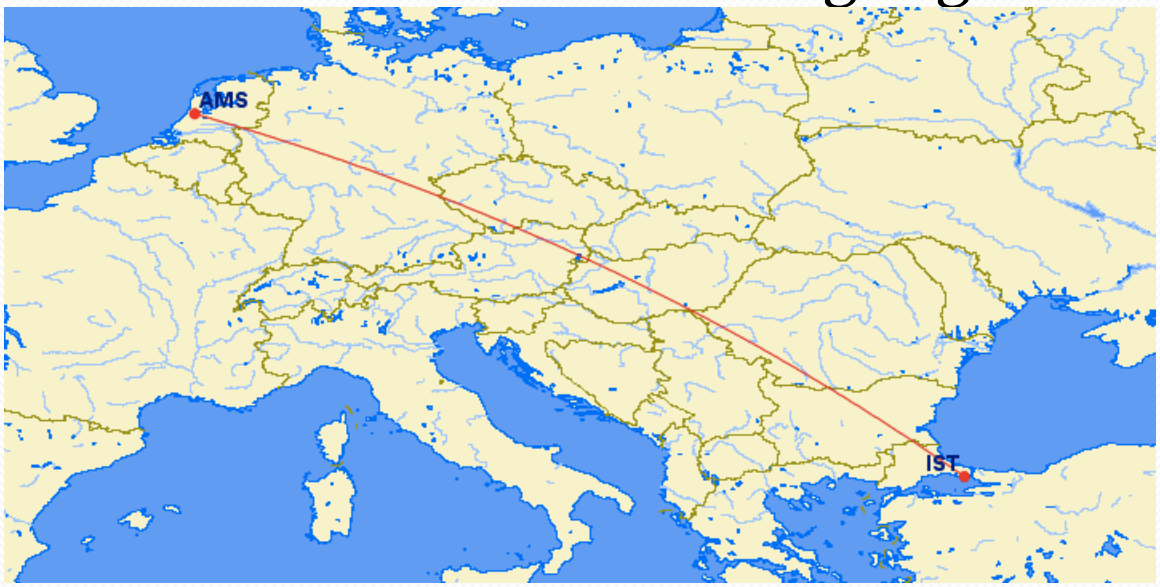
Introduction

- B.S Aeronautical Science and Professional Flight
- M.S Aeronautical Science & Aviation Safety,
  Embry-Riddle Aeronautical University

- Type Rating B737-300/900
- Currently F/O on A330/A340
- Flight Safety Officer at Turkish Airlines
- Accident Investigator for Turkish Transportation Ministry
- Automation/Human Factors Research

TK 1951, Boeing 737-800

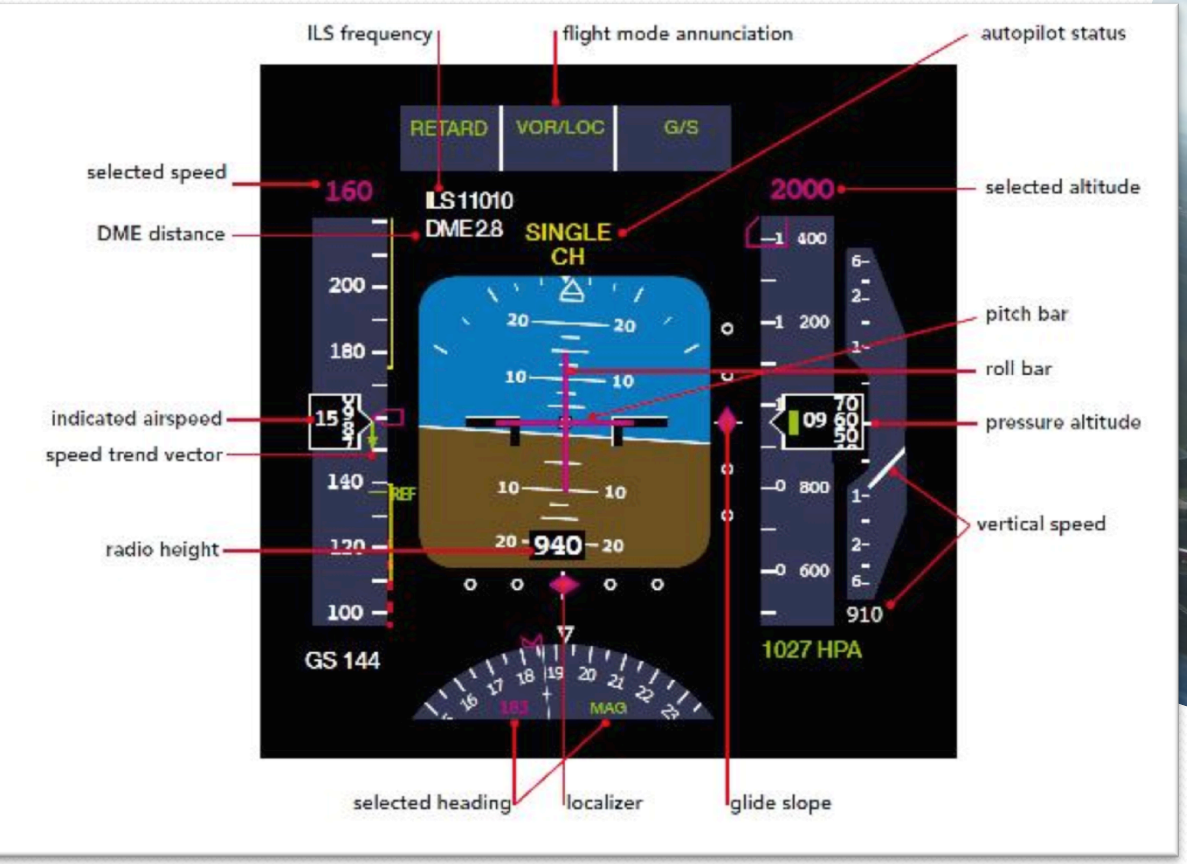
- Istanbul-Amsterdam LFUS Flight for F/O
- Aircraft had a history of RA problems reported
- Third seat was occupied by Safety Pilot
- No failures with automation during flight



TK 1951, Boeing 737-800

- Radio Altimeter (RA) functioned incorrectly
- Displayed -8 feet for a portion of the flight
- Incorrect value enabled RETARD mode for landing
- Aircraft was sequenced in shorter than normal
- Throttles required to be idle, masking main problem
- Aircraft entered stall, throttles were pushed forward
- Faulty RA caused throttles to RETARD again
- Aircraft crashed just short of touchdown

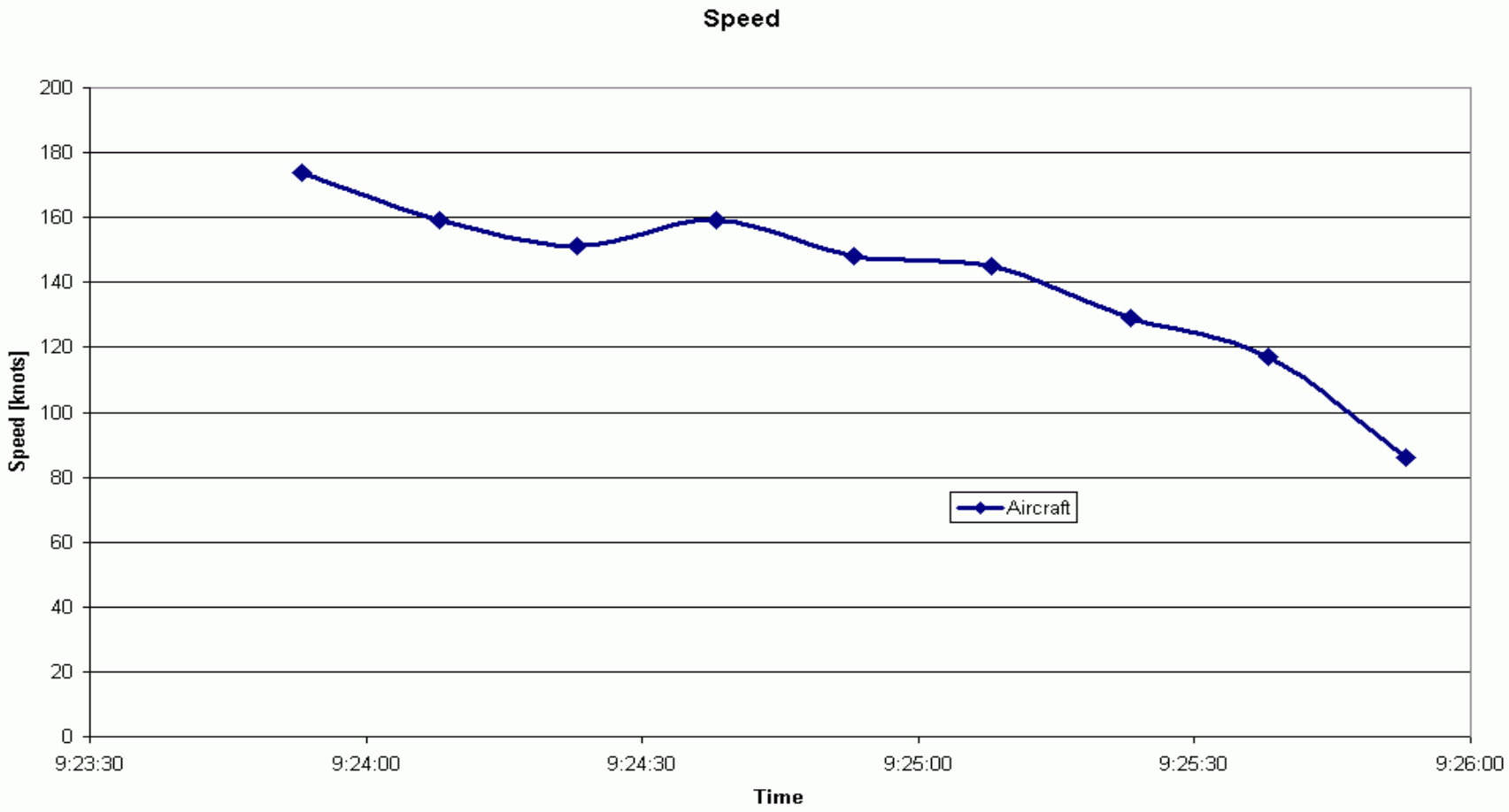
TK 1951, Boeing 737-800



TK 1951, Boeing 737-800

- Crew were aware of RA reading incorrect height
- Crew were *not aware* of the connection between the incorrect height and auto throttle function
- There are no documents that clearly state the connection between automation systems and other aircraft systems (cause-effect)
- There was no non-normal checklist for this sort of problem in flight – not much information available

TK 1951, Boeing 737-800



TK 1951, Boeing 737-800

Automation in Brief

- Does not mean **“automatic”**: may still need human input and most importantly, monitoring
- Executes preset tasks or executes commands based on conditions that are met
- Depending on the complexity of the system, the automation may or may not provide feedback to the user about its status
- Used to cut costs, and to reduce workload

Automation in Brief

- Studies have shown that automation causes complacency in humans as well as reduction in situational awareness
- Automation is the way of newer technologies, it is costly to reduce the levels, or to replace roles with humans
- Automation is being added into smaller and smaller steps and procedures in all systems, changing the human from an active to passive role

Situational Awareness (SA)

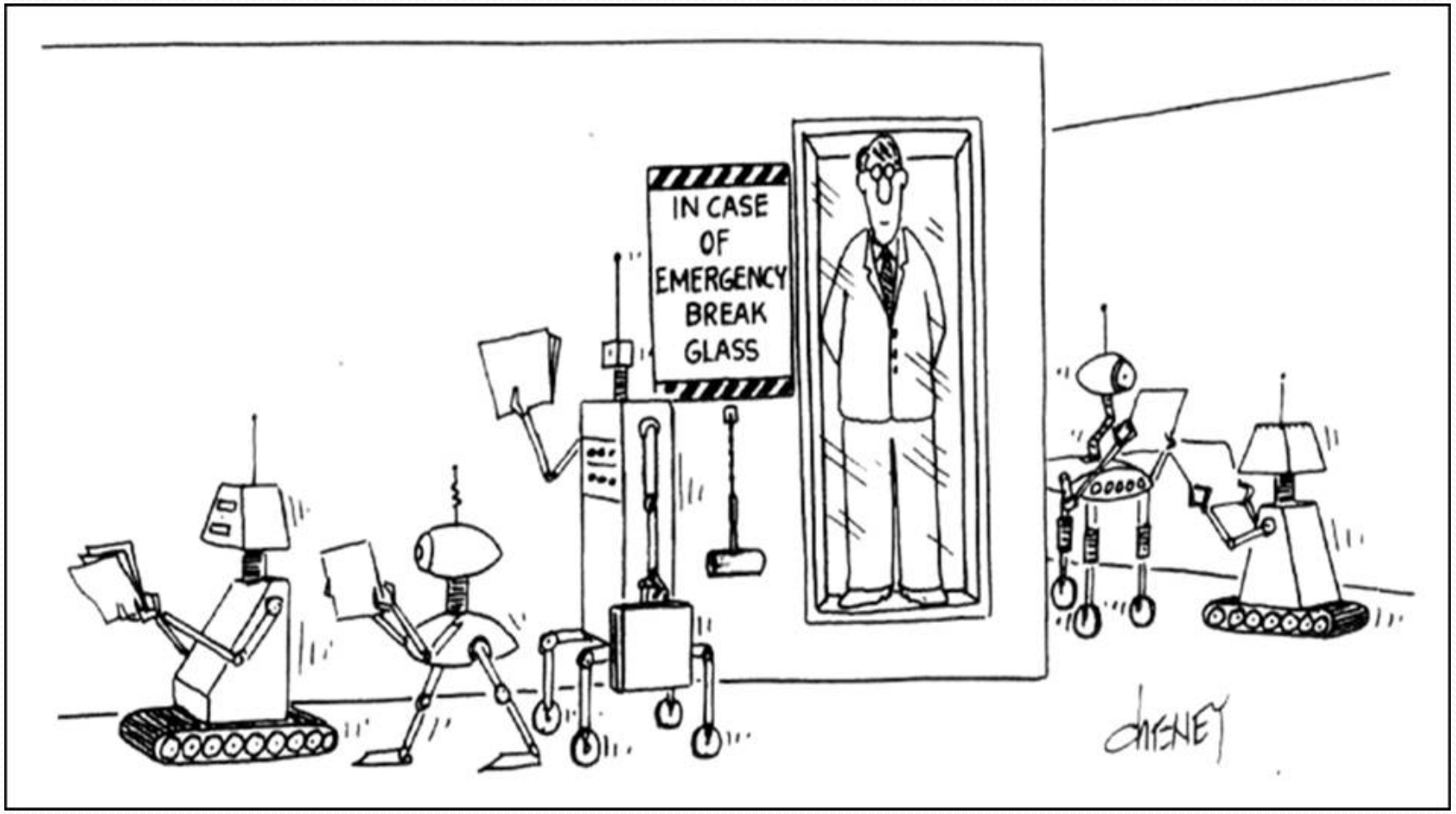
- *"perception of environmental elements within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future"*

- Detailed definitions only raise expectations, they don't help to get the results we want in aviation
- SA is influenced by many factors
- So what does the definition really mean?

Problems with Automation

- Automation can fail partially, or fail completely
- Automation can produce unexpected results
- Some failures are detectable and easier to deal with
- Some failures are complex and indirectly hurt other systems without the user being able to see
- The human is the last line of protection or intervention when automation goes wrong
- Sometimes the human never has a chance to intervene because of the system design

Problems with Automation



Problems with Automation

Automation and Pilots

- Studies have shown similar types of problems come up in different areas around the world
- Various automation induced problems for pilots such as “commission, omission, complacency…”
- Pilots are trained to revert to basic hand flying when and if automation fails to perform the desired task
- Often times, the automation failure may not be obvious to the pilot, and this drastically reduces the chance of an intervention and a safe recovery

Automation and Pilots

- Pilots get used to automation, because the error rate is very low, and they tend to believe it is correct
- When something does go wrong with automation, most pilots are taken by surprise according to studies
- Many reactions about automation include questions such as, “Why did it do that?” “What is it doing?” “Is it supposed to be doing that?”
- The general results of studies show that pilots will revert to manual control

Automation and Pilots

- Pilots don't tend to "look" for or wait for automation to make a mistake, in fact pilots want to trust their automation so they may concentrate on other procedures or events during flight
- When automation fails, or equally when automation is interpreted in a faulty way, the results can be deadly
- The interface between automation and pilot is very subjective, and more research is necessary to keep pilots at an active role

Viewpoint of Automation

WHAT HAPPENED ?

HOW DID IT HAPPEN ?

WHY DID IT HAPPEN ?

WILL IT HAPPEN AGAIN ?

Global Aviation Culture Change

- Analogue aircraft era is basically over for most of the world's airlines and operators
- Many mainline and upstart airlines now using more advanced technology aircraft and replacing older ones
- Some groups of pilots are required to change their fleet based on these trends (operational philosophy)
- Culture and language barriers are more evident as hand flying is less and system knowledge is key

Global Aviation Culture Change

- More aircraft are in the skies, and there are more pilots flying longer legs (exposure)
- The probability of automation related problems during global operations increases due to all the above
- Airlines hiring low time pilots due to demands
- The severity of events also increase because of more inexperienced crews and cultures in the cockpits as automation technology advances, the role of the human and his interaction drops even more

Global Aviation Culture Change

- The overall risk involved is much higher now, as this combination spreads
- Training syllabuses have barely changed to adapt
- The pilot is now more of a passive manager in the cockpit when compared to years ago (skill based vs knowledge based qualities)
- Adapting to new technology is not easy. How should it be done?

Adapting to Advanced Technology

- Type rating courses and recurrent courses do not contain detailed explanations of an aircraft's automation failures
- Simulator certification does not touch on this subject
- Basic modes of automation are taught in these sessions as a skill set, but the errors of systems and the relationships between various systems are not taught, let alone described in the manuals

Adapting To Advanced Technology

- Is it time for a restructuring of training programs?
- How will your company or organization tackle the user as being a passive manager ?
- A new database should be created for operators to track automation failures and problems
- An improved system of sharing automation issues and problems on a global level is needed (user, producer, designer and auditor)

Conclusion

- Automation is here to stay
- The gap between human ability and machine capability is growing
- Automation is becoming more automated, and less information is available to pilots to make a decision about faults and failures
- Humans are the limiting factor in this day and age of technology

Thank you!