

Human and Organizational Factors in SAIB Safety Investigations

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Daniel W. Knecht

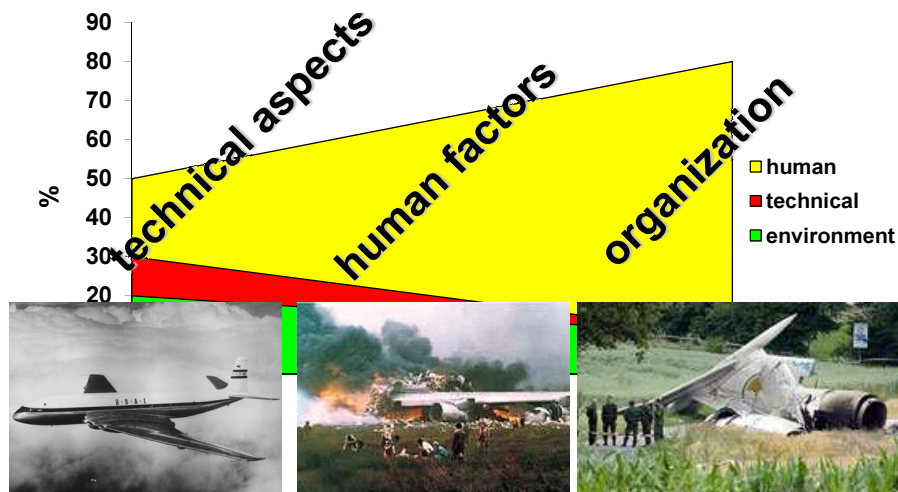


Agenda

- Causal factors and emphases in accident investigation
- Human and organizational factors investigation – an example
- Systemic issues instead of “*bad apple elimination*” – another example
- Summary



Causal factors and emphases in aviation accident investigation



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History of the flight – general framework

- Scheduled flight CRX 498 to Dresden
- 7 passengers and 3 crew members
- Commander was pilot flying
- Meteorological conditions
 - Wind 290/2
 - Visibility 6 km in drizzle
 - BKN 500 ft AGL
 - Top of clouds 5000 ft AMSL (ca. 3500 ft AGL)
 - 2 °C/1 °C (on ground)
- End of civil twilight on January 10 at Zurich: 16:36 UTC

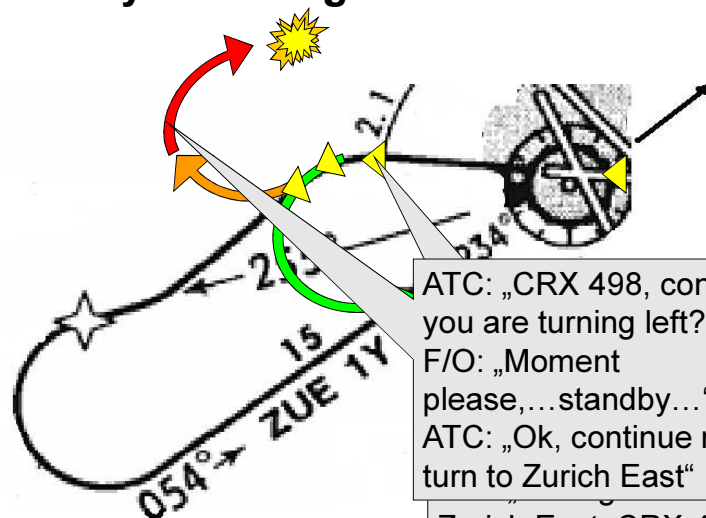
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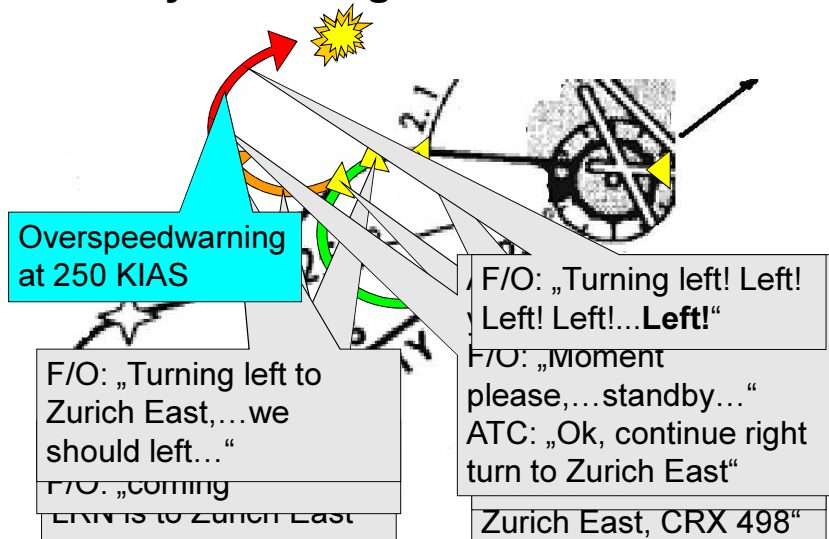


ATC: „CRX 498, confirm,
you are turning left?“
F/O: „Moment
please,...standby...“
ATC: „Ok, continue right
turn to Zurich East“
Zurich East, CRX 498“

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History of the flight



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Aircraft Saab 340B HB-AKK

- Reconstruction
- Fire
- Instrumentation and equipment

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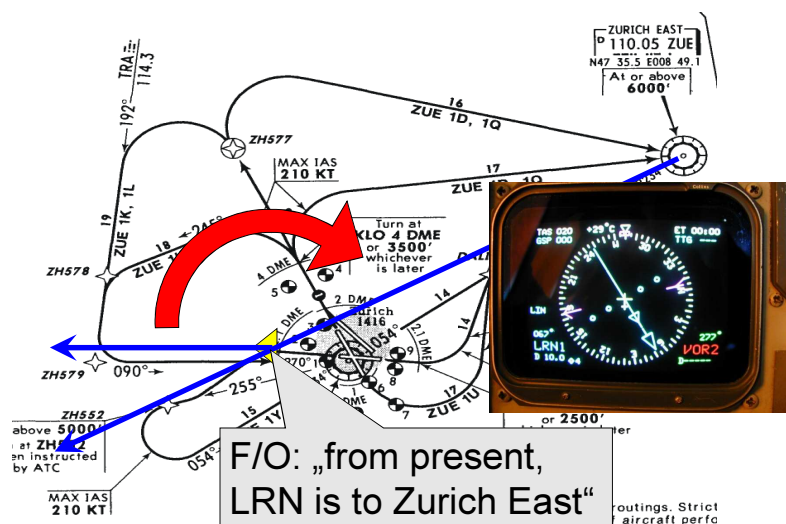


Aircraft Saab 340B HB-AKK

- Controls/gust lock
- Electromagnetic interference
- Constellation of GPS satellites
- Performance – no icing
- Maintenance – several minor items
- Airworthiness – no problem



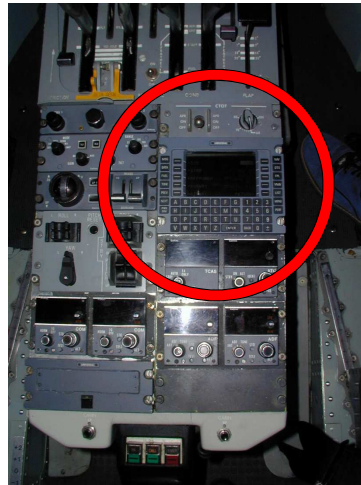
FMS programming at 2.1 DME KLO





Ergonomy

- FMS was a retrofit – located on the central pedestal
- Simulator without FMS – on the job

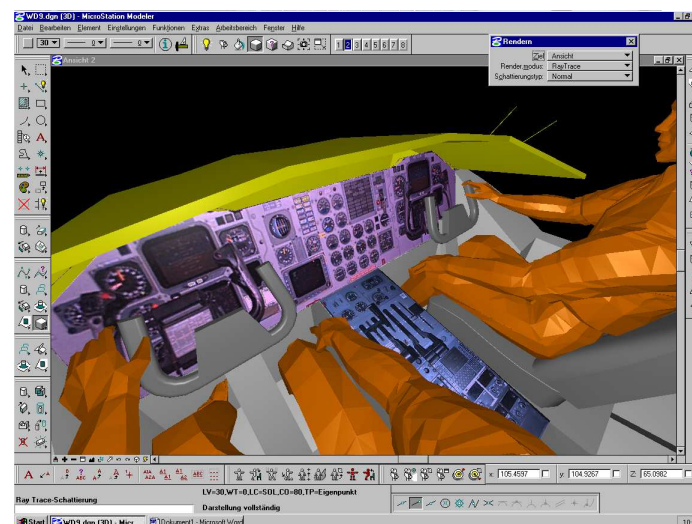


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Ergonomy

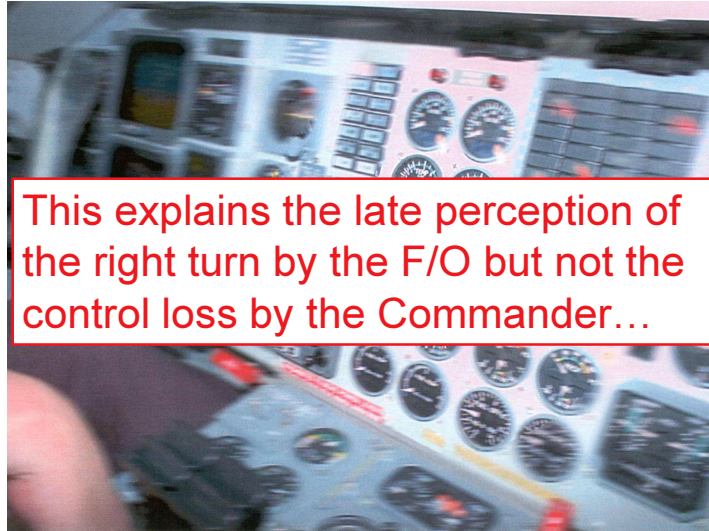


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Ergonomy



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Research in Moldavia and Russia

- Selection and training of the flight crew
- Operational aspects of the eastern aviation system
- Simulator flights on AN-24



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Commander

- Citizen of the Republic of Moldova, born 1958
- Experience
 - 8452 h total
 - 4645 h as PIC
 - 1870 h on Saab 340
- Training
 - Civil aviation pilot-engineer CAA Leningrad
 - VFR commercial flights on AN-2, KA-26 helicopter
 - Conversion to AN-24
 - 1997: conversion to Saab 340



Commander

- Social background
 - Separated from his family
 - Restricted social network
 - Lease pilot – modest financial circumstances
- Medical findings - Phenazepam





First Officer

- Citizen of the Republic of Slovaia, born 1965
- Experience
 - 2332 h total
 - 1162 h on Saab 340
- Training
 - 1989 to 1996: Commercial pilot licence
 - 1996: Multi engine and instrument rating
 - 1997: conversion to Saab 340



First Officer

- Social background
 - Separated from his family
 - Normal regional carrier salary
- Pilot's assessment
 - Tendency to intervene with delay
 - Latent weakness in decision-making and establishing priorities



Intercultural aspects

- Cockpit procedures/CRM
- Bank angle warning
- Attitude indicator and directional gyro



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Organizational aspects

- Employment market exhausted
- Pilots from different countries and cultures
- Short assessment procedure, focused on flying skills
- Lack of information about cultural background
- Terms of employment – low salaries

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Direct causal factors

- No use of autopilot under IMC
- Inappropriate reaction of the crew to the change of the departure clearance
- Due to spacial desorientation the pilot flying took the aircraft into a spiral dive
- Pilot non flying took inadequate measures to prevent or recover from the spiral dive



Direct contributing factors

- Under stress, the pilot flying resorted to a reaction pattern (heuristics) which he had learned earlier
- The PF's capacity for analysis and critical assessment of the situation were possibly limited as a result of the effect of medication.
- The flight crews communication was restricted to a functional vocabulary for standard situations



Systemic causal factors

- Cultural and technical background of flight crew members from the operational environment of the former Soviet Union were not known in Switzerland
- Lack of supervision by the regulating authority
- The PF was not systematically acquainted by the operator with specific features of western systems and cockpit procedures

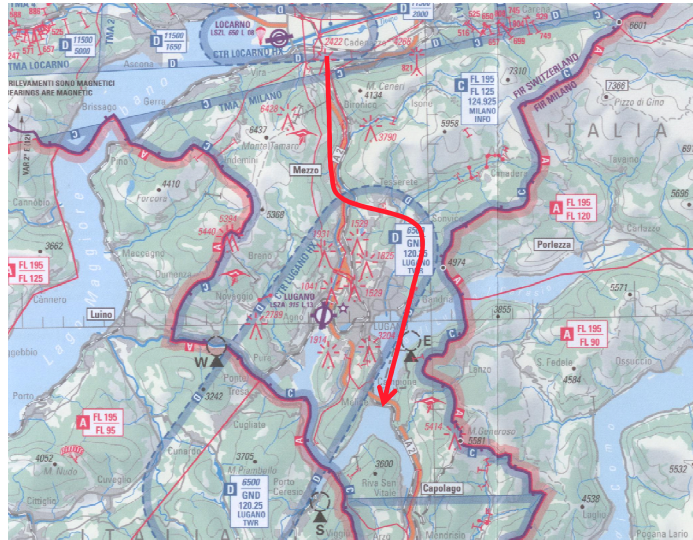


Airspace D and TCAS

- SAAB 2000 SWR 75PE, scheduled flight, visual approach Lugano
- PC7 NC A-939, assessment flight of the SAF pilot school, take off in Locarno
- Typical student flight experience: 30 h total, 17 h on PC7 NC



Mission layout

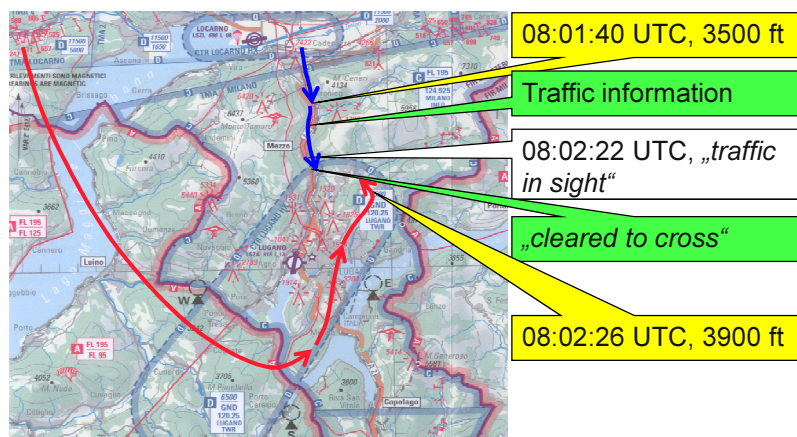


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SWR 75PE vs A939

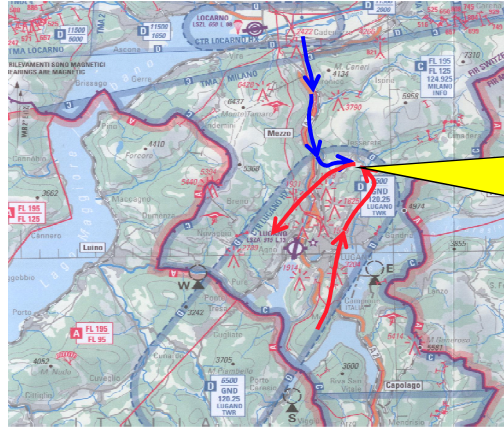


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SWR 75PE vs A939



TCAS resolution advisory (RA)
„climb, climb!“
0.5 NM/200 ft



From bad apple to systemic issues

- SAF flight instructor
 - ATPL(H) and CPL (A) according to JAR
 - IR on helicopter and aeroplanes
 - civil flight instructor
 - 3932 h flight experience
- How can an experienced and highly skilled pilot misinterpret or misunderstand basic class D airspace TCAS rules?
- Bad apple or systemic problem?



Anonymous survey on VFR flying in class D airspace

Bitte kreuzen Sie die zutreffenden Angaben zu Ihrem fliegerischen und persönlichen Hintergrund an:

Ich besitze folgende Lizenzstufen	Ich besitze folgende Berechtigungen (ratings)
Segelfliegerausweis GLI	Single engine piston SEP
Privatpilotenausweis Flächenflug PPL(A)	Touring motor glider TMG

241 pilots
114 with PPL(A) and PPL(H)
82 with CPL(A) and CPL(H)
42 with ATPL(A)
including 106 with flight instructor rating

Die ATC überwacht, dass ich auf meinem Flugweg nicht mit dem Gelände kollidiere und warnt mich nötigenfalls.		
Die Mindestabstufung zwischen IFR- und VFR-Verkehr im Luftraum der Klasse D beträgt vertikal 1000 ft und horizontal je nach Präzision des Radars 3 oder 5 NM.		



Airspace D – Anonymous survey

In Class D airspace, air traffic control ensures adequate separation (a sufficient lateral and vertical distance) between IFR and VFR traffic, e.g. by providing heading and altitude instructions.

Agreement as a percentage of the respective group				
All	Private pilots	Commercial pilots	Airline transport pilots	Flight instructors
68.5	75.4	55.1	70.0	60.4



Airspace D – Anonymous survey

In a Class D control zone, the air traffic controller can detect, e.g. by means of radar, whether the distance between two aircraft is sufficient and if necessary can give heading and altitude instructions in order to ensure this distance.

Agreement as a percentage of the respective group				
All	Private pilots	Commercial pilots	Airline transport pilots	Flight instructors
78.0	79.8	80.8	72.5	74.5



Summary

- Accidents or serious incidents with human and organisational issues nevertheless require a careful technical investigation.
- Modern recording equipment can provide useful data, but organizational, cultural, sociological research is decisive.
- Systemic investigations are effortful, but they lead to better and more effective prevention measures than the old „*bad apple elimination*“.