TCAS operational aspects
a pilot’s point of view

Captain Wolfgang Starke
TCAS – some basics

- Threshold for TAs: 20 – 48 seconds
  altitude threshold 850 to 1,200 ft.
- Threshold for RAs: 15 – 35 seconds
  altitude threshold 600 to 800 ft (preventive)
  300 to 700 ft for corrective RAs.
- Range threshold 0.2 to 1.1 NM for RAs
TCAS – manoeuvre, how to fly

- vertical manoeuvre be initiated within
  - 5 seconds (initial RA)
  - 2,5 seconds (modification of initial RA)
- strength of vertical manoeuvre
  ≈ 0.25g for initial and weakening RAs
  ≈ 0.33g for subsequent RAs
- vertical speeds from 1,500 to 2,500 ft/min
TCAS – training requirements

ICAO PANS-OPS
Attachment A, Part III, Chapter 3, Section 3

5.4 Pilots should fly all scenarios once every four years.

5.5 Pilots should complete all scenarios once every two years if CBT is used.

➡️ Sufficient training???
➡️ Targets of training correct?
TCAS – training requirements

ICAO PANS-ATM 3.2.c(6)
“limit the alterations of the flight path to the minimum extent necessary to comply with the RAs;”

Something from a manufacturer’s AFM:
“climb, climb” – climb at rate shown on the green arc of the IVSI/PFD
Present ACAS-displays look like a “fly to” (green arc) indication!

According to ICAO PANS-ATM it is a „fly away from“ (red arc) indication as alterations need to be limited to the MINIMUM EXTENT NECESSARY to comply with ACAS RAs.
How is this displayed?
TCAS – display options

Typical up-to-date TCAS-indication on IVSI.

Climb-RA:

- red tape up to 1.500 ft/min
- green tape from 1.500 – 3.500 ft/min

Precise fly-to indication?
TCAS – display options

Typical indication onboard a Boeing 737-800NG.

ACAS-advisory is shown as area where the pitch of the aircraft SHALL NOT BE!
TCAS – display options

ACAS-display onboard of an Embraer 190.

Green fly-to zone for the flight path vector.
TCAS – display options

Display on a A380 equipped with A/P flight director TCAS-mode.

Precise “fly-to” command on ADI.
TCAS – way forward ...

→ ACAS need to feature a precise “fly-to” indication to assist pilots
→ automation may be an option!
→ use of autopilot shall not be forbidden by SOPs

→ training of pilots need to be more realistic
→ more training (every year at least!)
→ precise compliance needs to be emphasized
TCAS – time to discuss

Thank you for your attention!