

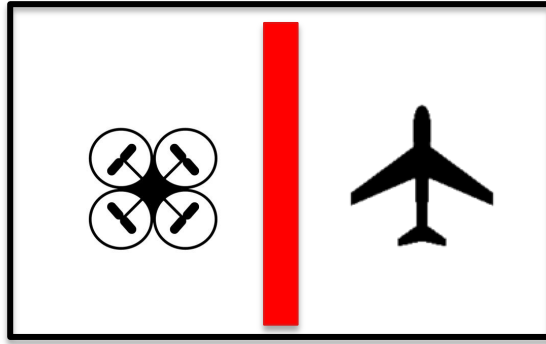
Agent-based modelling and simulation of risk of collision between a drone and a commercial aircraft

Busso Friedrich Gellert

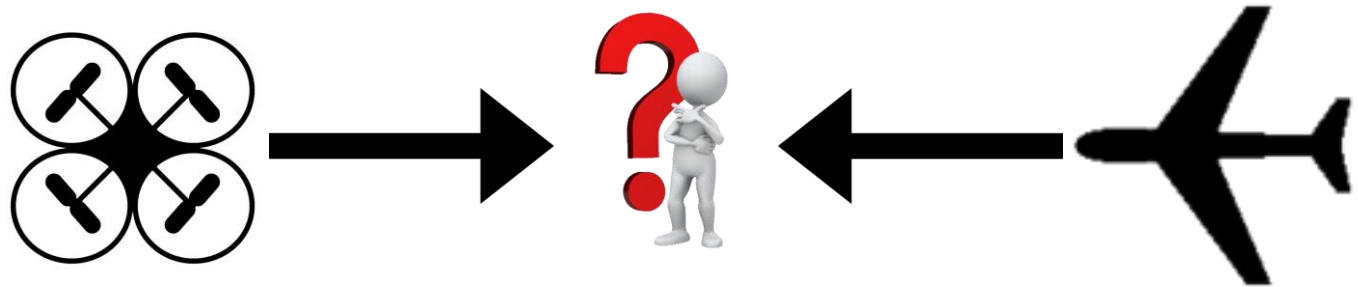
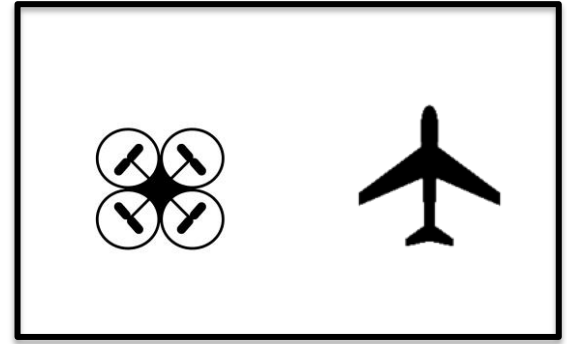
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Project Description

Today!



Tomorrow?



Research objective

- Development of model to estimate the risk of collision between a commercial aircraft and a drone

Scope

Airspace type:

- En-route traffic



Scope

Drones:



Scope

Commercial aircraft:



Methodology

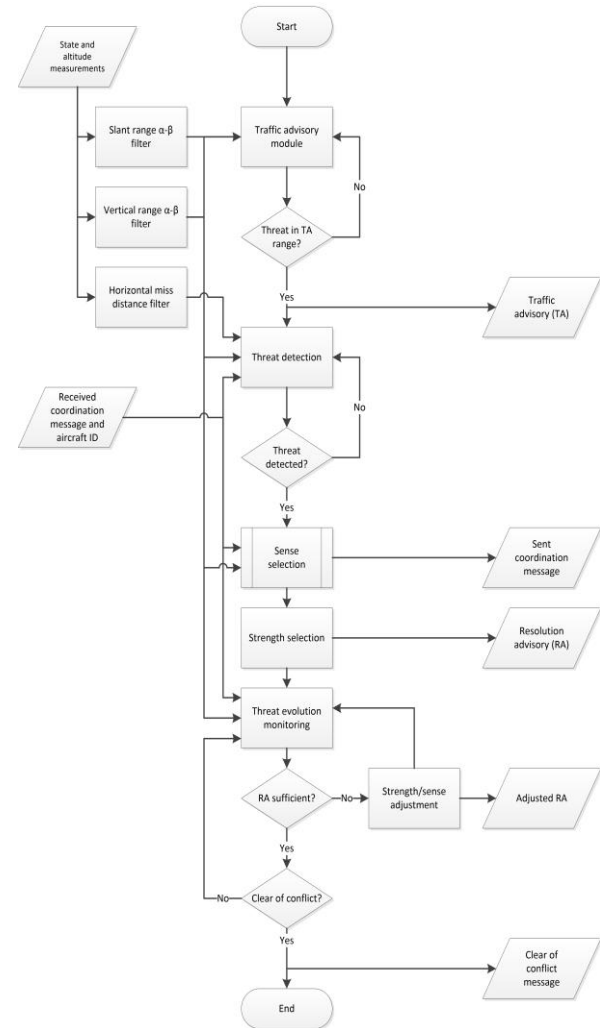
- Agent-based model including:
 - TCAS II Ver.7.1
 - ACAS X_u
 - Aircraft evolutions
 - Pilot behaviour
- Simulation
 - Monte Carlo simulation
 - MATLAB

Difficulties

- TCAS II not developed for to work with other ACAS!
 - How much may be simplified in model?
- ACAS X_u so far only a concept
 - Own creation necessary

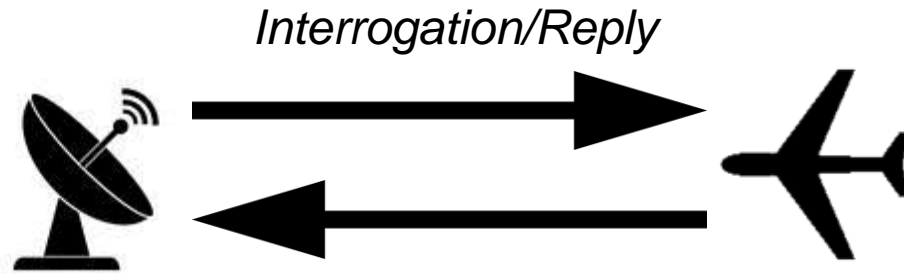
TCAS II Ver.7.1

- TCAS II Ver.7.1 concept:



TCAS II Ver.7.1

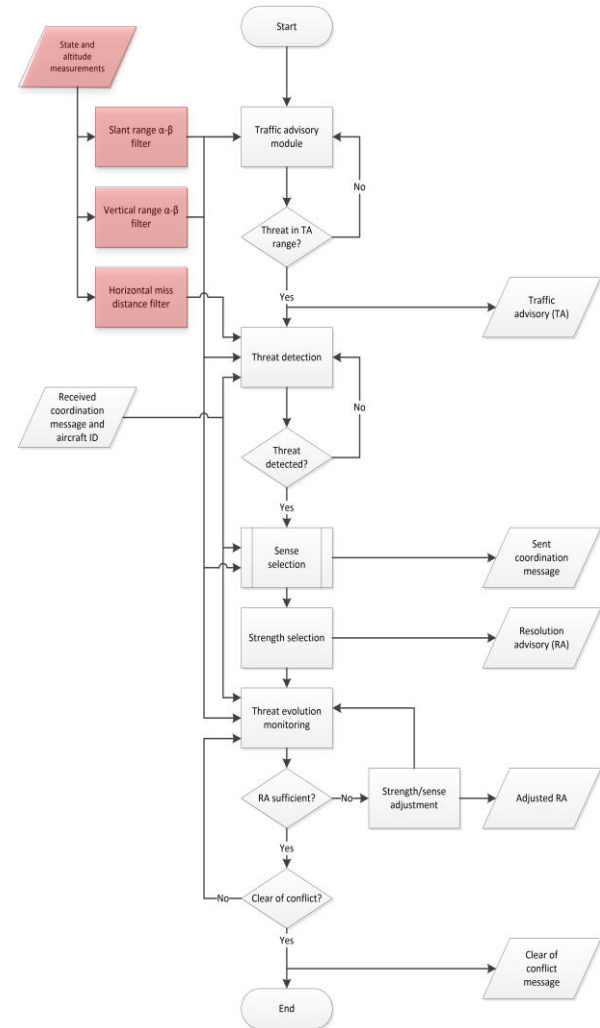
- Range measurements:



Measurement Errors

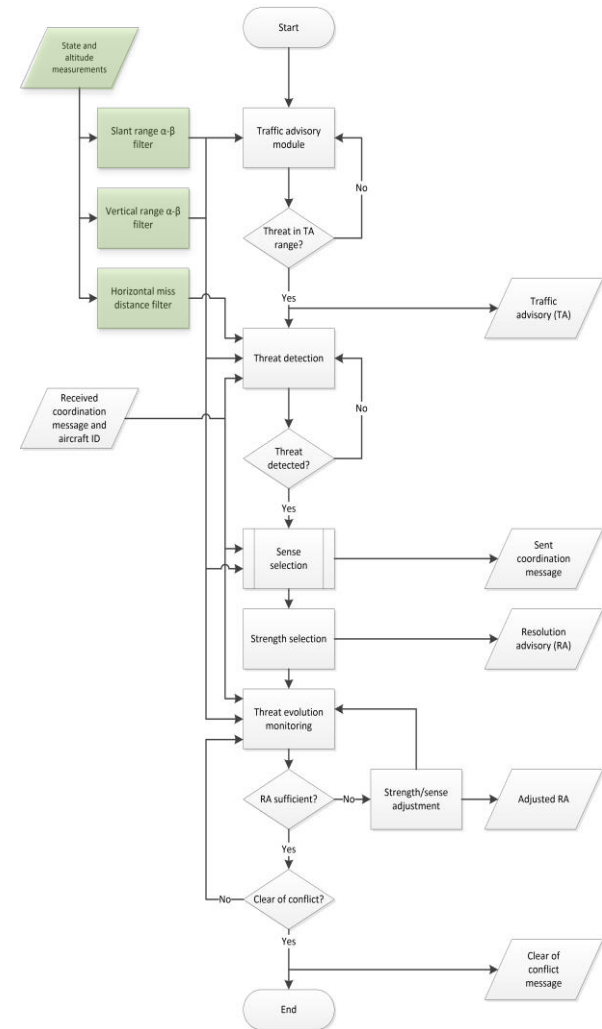
TCAS II Ver.7.1

- Current models usually do not take uncertainty into account
- Measurements are equal to real positions



TCAS II Ver.7.1

- My model also considers:
 - Measurements errors
 - α - β filters to estimate slant range, slant rate, altitude difference, relative altitude rate
 - horizontal miss distance filter to suppress nuisance alerts



Discussion Points

- Is it realistic that authorities will allow access to non-segregated airspace for drones which are capable to cooperate with TCAS equipped aircraft?
- If yes, what will be the requirements?