

## 7.2 Testing Configuration

All *simulations* are run with configuration described in this *section*. The UAS used for the purposes is given by *model and control* (sec. ??).

*UAS parameters:* An *UAS system* (tab. 7.2) is modeled after small scale toy model with: maximal body radius 30 *cm*, maximal speed 4 *m.s*<sup>-1</sup>, weight 450 *g.*, maximal flight duration 20 *min*, maximal turning rate 15 *deg.s*<sup>-1</sup>. The *body margin* is set to 0.3*m*, the *near miss radius* is double of *body margin*, thus 0.6 *m*, the *well clear radius* is set to 5 *m*. Margins can be set to any value if they are complaint with condition (7.1).

$$0 < bodyMargin \leq nearMissRadius \leq wellClearRadius \leq gridDistance \quad (7.1)$$

*Note.* *Safety margin* is broad term used to describe *minimal distance* between UAS and *adversarial object*. The *Safety margin* is:

1. *near miss radius* in case of *non-controlled airspace* or *emergency avoidance mode*.
2. *well clear radius* in case of *controlled airspace* and *navigation mode*.

**Decision time:** Decision time can be set by the user to any positive non-zero value (7.2). The *Decision time* is equal 1 *s* and *Decision frames* are synchronized.

$$maxAlrogorithmCalculationTime \leq decisionTome \leq \infty \quad (7.2)$$

**Speed:** For *all movements* constant speed 1 *m.s*<sup>-1</sup> is used. Speed can be changed to any value in given boundary (7.3).

$$0 \leq speed \leq \min \left( \begin{array}{l} 0.5 \times (navigationGrid.distance/decisionFrame) \\ 0.5 \times (avoidanceGrid.distance/decisionFrame) \end{array} \right) \quad (7.3)$$

**Movement automaton:** The *movement set* is given in (tab. 7.1). The *movement set* contains horizontal, vertical, and, combined movements.

**Grids:** Used *Navigation grid parameters* are given in (tab. 7.3). Selected *Navigation Reach set* is *ACAS-like* with enabled horizontal/vertical separation. Used *Avoidance grid parameters* are given in (tab. 7.4). Selected *Avoidance Reach set* is *combined* because of high *coverage ratio*.

User can define own grid parameters according to the *space discretization rules* (sec. ??) and chose own *reach set type* according to preference (sec. ??).

Movement	Roll	Pitch	Yaw
Straight	$0^\circ$	$0^\circ$	$0^\circ$
Left	$0^\circ$	$15^\circ$	$0^\circ$
Right	$0^\circ$	$-15^\circ$	$0^\circ$
Up	$0^\circ$	$0^\circ$	$-15^\circ$
Down	$0^\circ$	$0^\circ$	$15^\circ$
UpLeft	$0^\circ$	$15^\circ$	$-15^\circ$
UpRight	$0^\circ$	$-15^\circ$	$-15^\circ$
DownLeft	$0^\circ$	$15^\circ$	$15^\circ$
DownRight	$0^\circ$	$-15^\circ$	$15^\circ$

Table 7.1: Movement orientations.

UAS parameters	
speed	$1\text{ ms}^{-1}$
horizontal turning r.	$3.82\text{ m}$
vertical turning r.	$3.82\text{ m}$
body radius	$0.3\text{ m}$
near miss r.	$0.6\text{ m}$
well clear r.	$5\text{ m}$

Table 7.2: *UAS* parameters.

Navigation Grid	
type	ACAS-like
distance range	$0 - 10\text{ m}$
layer step	$1\text{ m}$
horizontal range	$\pm 45^\circ$
horizontal cells	7
vertical range	$\pm 30^\circ$
vertical cells	5

Table 7.3: *Navigation Space* parameters.

Avoidance Grid	
type	combined
distance range	$0 - 10\text{ m}$
layer step	$1\text{ m}$
horizontal range	$\pm 45^\circ$
horizontal cells	7
vertical range	$\pm 30^\circ$
vertical cells	5

Table 7.4: *Avoidance Space* parameters.

Coloring		
Airc.	Executed	Planned
UAS 1	blue	red
UAS 2	cyan	magenta
UAS 3	green	yellow
UAS 4	black	green

Table 7.5: *UAS* coloring.

# Bibliography