GPP UPDATE

GHENT
UNIVERSITY

GLOBAL PATH PLANNING REQUIREMENTS

Group	Constraint	Format	Comment
Mission	Obstacles (known)	3D coordinates	
	Origin	4D coordinates	Time absolute or relative
	Destination	4D coordinates	
	Obstacles clearance	Lateral / Vertical distance	See D2.1 SR Table 3-1
	POI (known)	4D coordinates	Time absolute or relative
	POI action	Path WPTs 4D coordinates	
VLLATM	Airspace volume	3D coordinates (geofence) + timeframe validity of restriction [UTC in/out]	P/D/R Areas, No-Fly Zones (NFZ), Temporary Restricted Areas (TRA), Temporary Segregated Areas (TSA), CTR zones
	Route clearance	WPT coordinate + RTA	
UA	Endurance		Safe endurance [sec]: Maximum flight time with given payload, fuel quantity and given density flight altitude.
	Flight speed	Array data structure	Best endurance speed [kts]: Vy speed
	Flight envelope	Array data structure	Density altitude limitation; H/V limitation;
	Meteorological envelope	Array data structure	Maximum wind speed; Minimum OAT
Environment	Wind speed / direction	(W) Direction [deg] / (V) speed [knots]	Pre-flight (meteo source); In-flight (calculation)
	Overflight noise	Polygon 3D coordinates	Pre-flight / In-flight
	End-of-conflict position	3D relative coordinates	In-flight
Infrastructure	Recharge	3D coordinates	Applicable to eUAVs

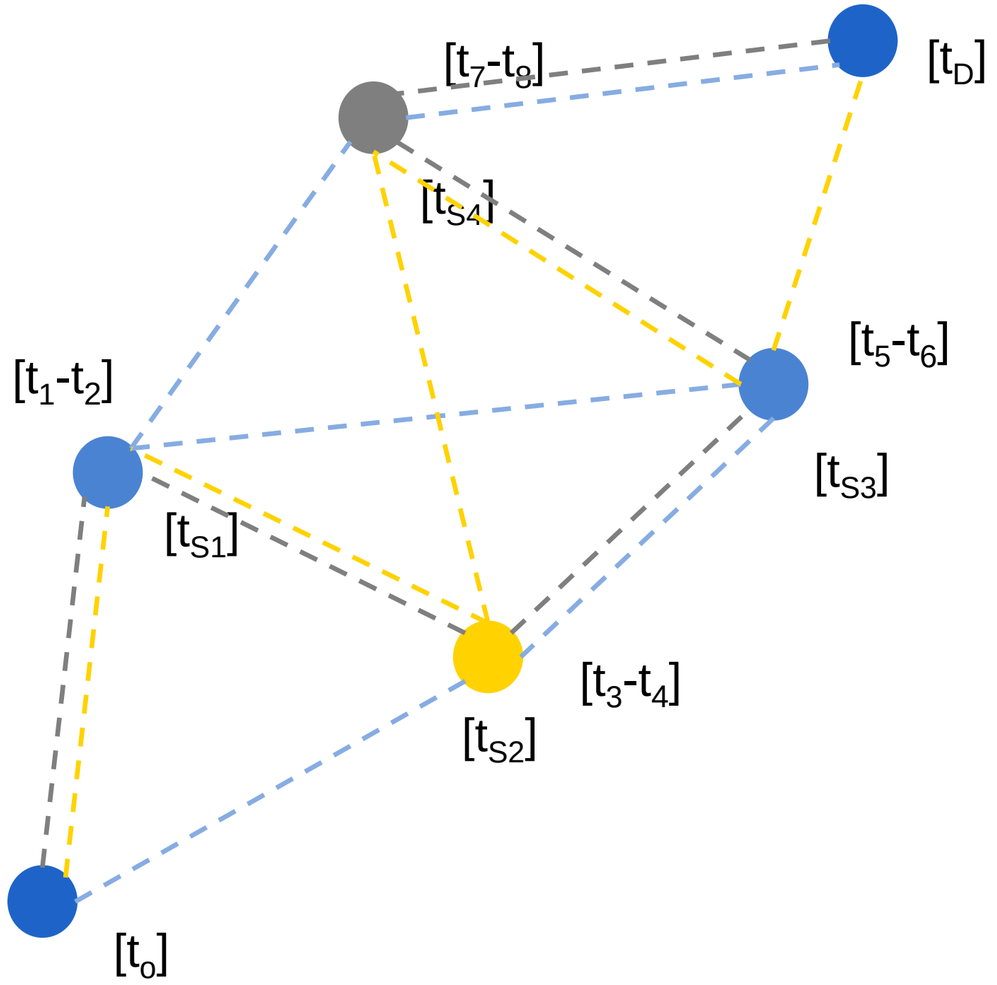
POINTS

- Origin
- Destination
- Point of interest (PoI)
- PoI action
- End of conflict
- Recharging stations

GHENT
UNIVERSITY

POINTS

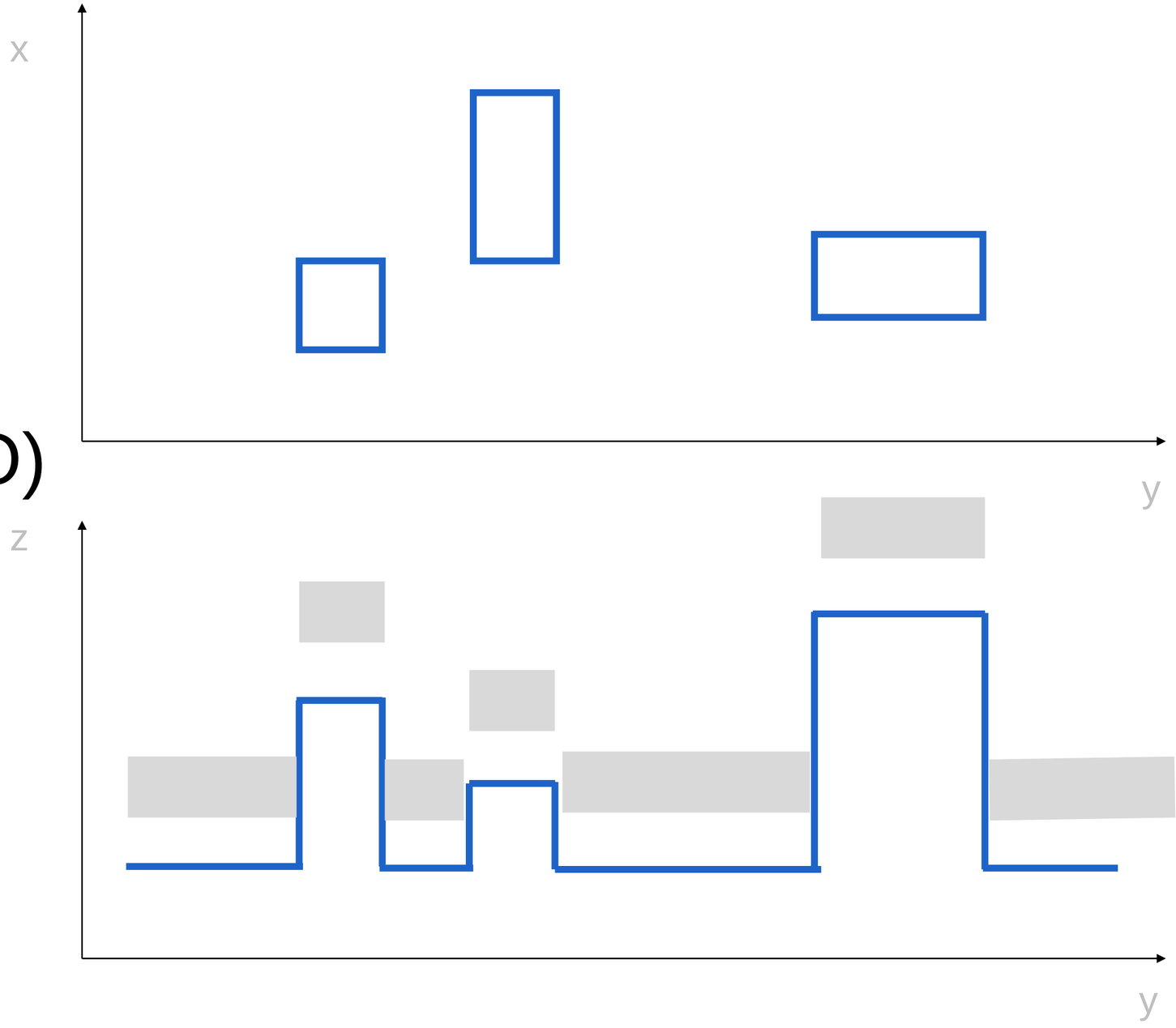
- Origin
- Destination
- Point of interest (PoI)
- PoI action
- End of conflict
- Recharging stations



GHENT UNIVERSITY

SEARCH SPACE

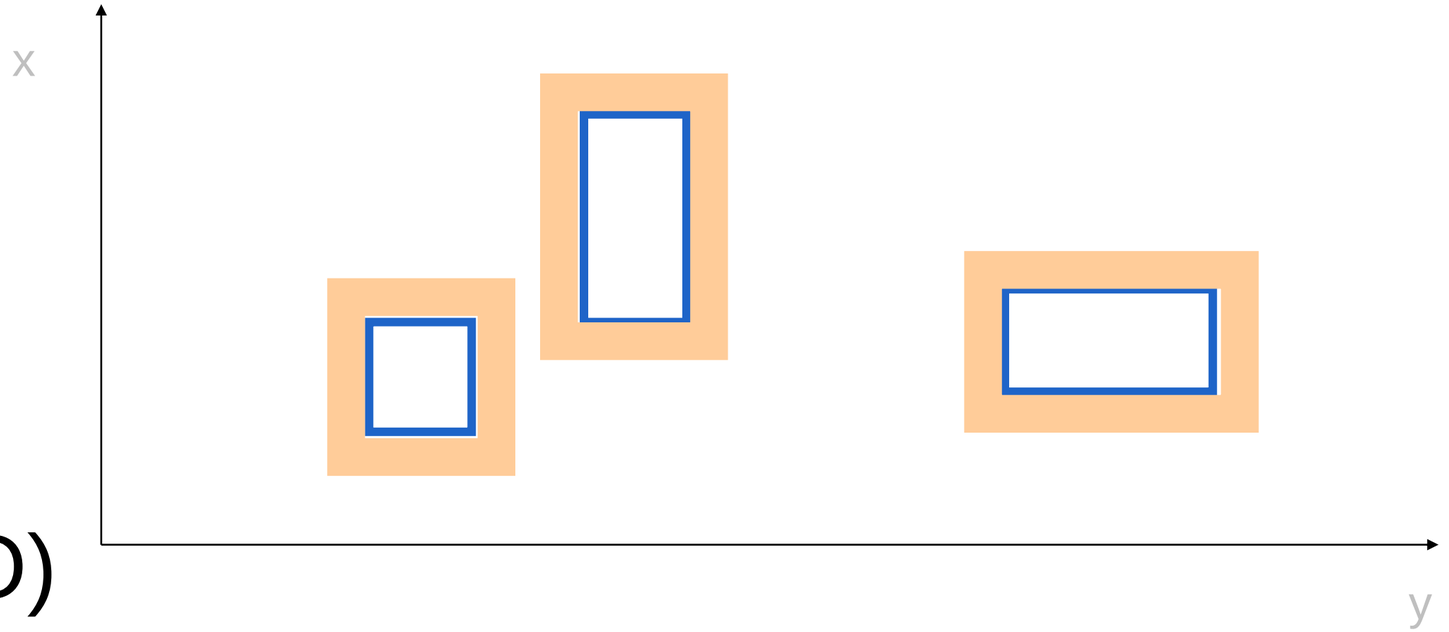
- Mission height
- Clearances
- Airspace volumes
- Route clearance (I/O)

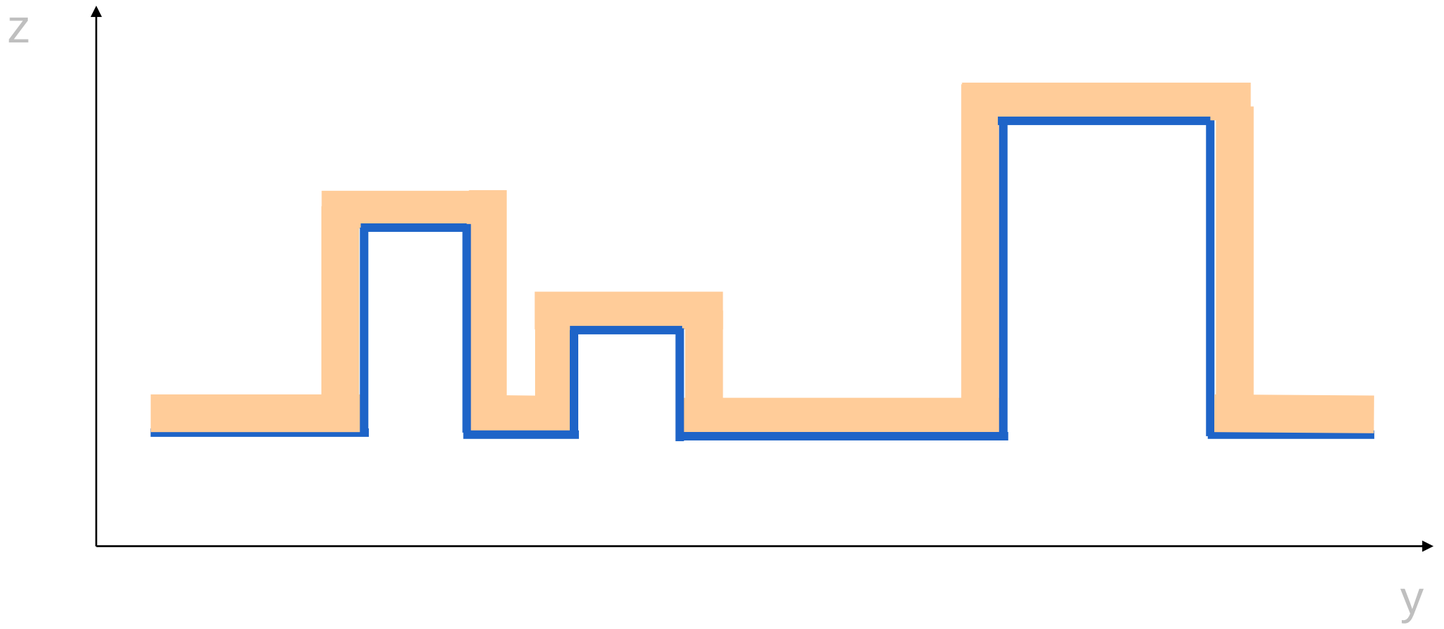


GHENT UNIVERSITY

SEARCH SPACE

- Mission height
- Clearances
- Airspace volumes
- Route clearance (I/O)

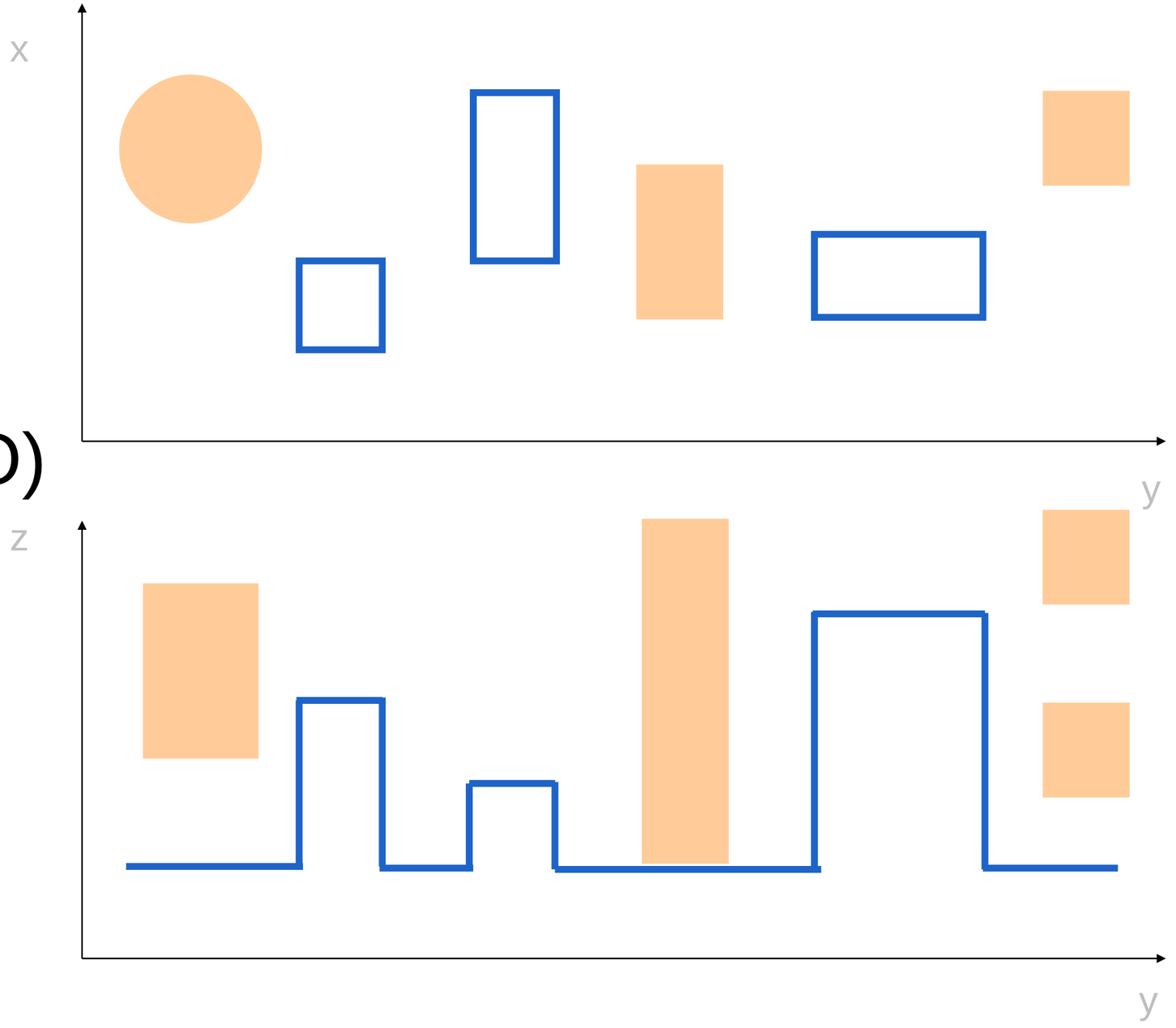




GHENT UNIVERSITY

SEARCH SPACE

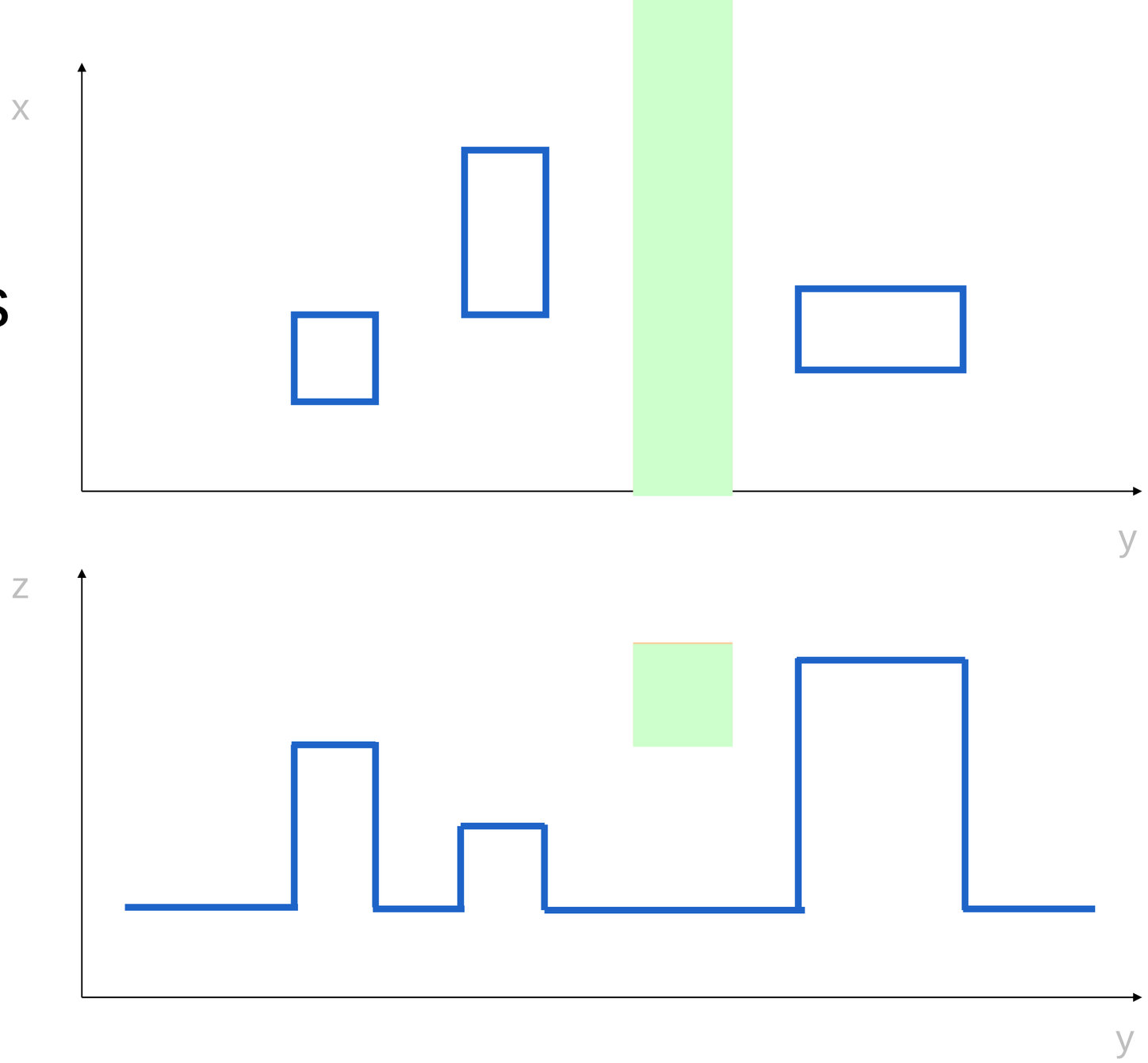
- Mission height
- Clearances
- Airspace volumes
- Route clearance (I/O)



GHENT UNIVERSITY

SEARCH SPACE

- Mission height
- Obstacle clearances
- Airspace volumes
- Route (I/O)

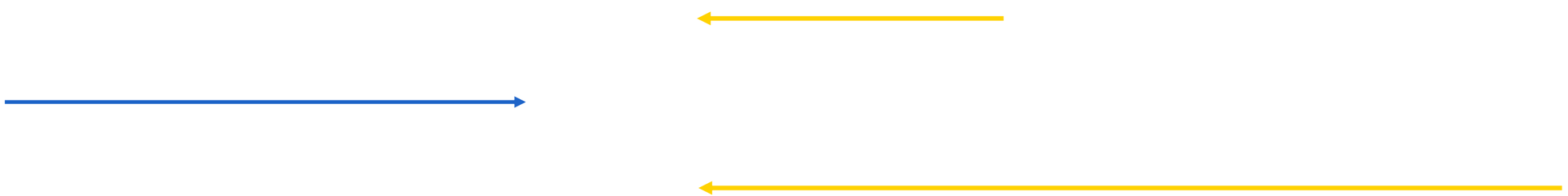


GHENT UNIVERSITY

ENVIRONMENT

- Wind speed and direction
- Temperature

- Cost function (endurance and time)



GHENT UNIVERSITY

ENVIRONMENT

- Wind speed and direction
- Temperature

- Cost function (endurance and time)

GHENT UNIVERSITY

ENVIRONMENT

- Wind speed and direction
- Temperature

- Cost function (endurance and time)

GHENT UNIVERSITY

ENVIRONMENT

- Wind speed and direction
- Temperature

- Cost function (endurance and time)
  - Given the speed and the direction of UAV movement and given the wind speed and direction and temperature calculate the remaining endurance of the UAV
  - Wind speed and temperature are given (read) priory the flight (in a short time interval) and updated during the flight. The endurance is calculated at the beginning of the flight (estimated endurance) and updated together with the received wind and temperature conditions (remaining endurance)
  - Wind and temperature are not the same at the same moment at all the heights / locations
  - Dependance of the temperature on the height should be modeled also

GHENT UNIVERSITY

FLIGHT ENVELOPE

- Position
- Speed
- Height
- Temperature
- Wind

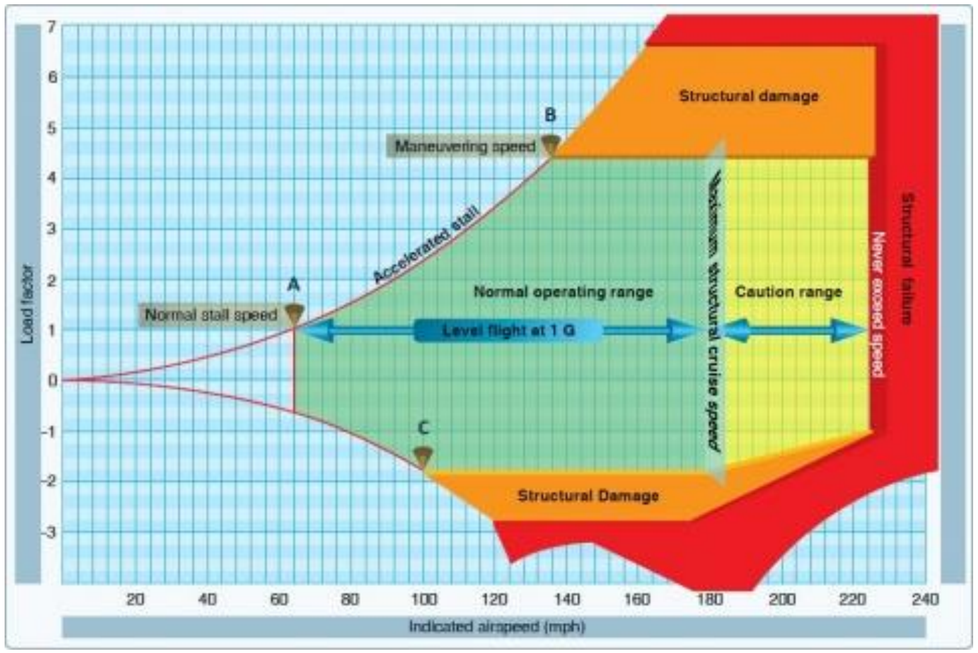
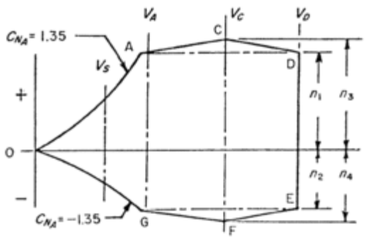
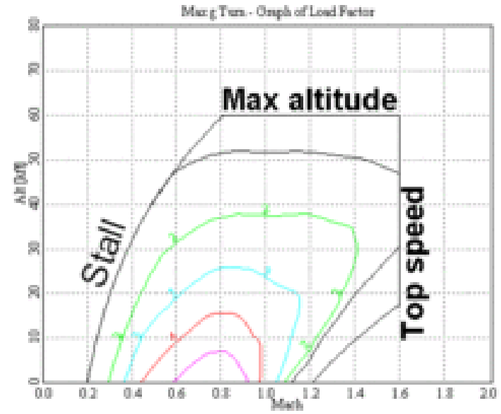


FIGURE A-4—FLIGHT ENVELOPE



1. Conditions "C" or "F" need only be investigated when $n_1 \frac{W}{S}$ or $n_2 \frac{W}{S}$ is greater than $n_3 \frac{W}{S}$ or $n_4 \frac{W}{S}$, respectively.

2. Condition "G" need not be investigated when the supplementary condition specified in § 23.369 is investigated.



GHENT UNIVERSITY

LOGIC

- Search space defines the space where the path solution is possible

- Flight envelope defines feasibility of the potential paths in the search space

- Environment: determines the energy consumption which in combination with the flight performance (e.g., speed, acceleration, internal energy consumption,…) constraint the endurance (travel time and respectively the path length)

GHENT UNIVERSITY

POINTS OF ACTIONS

- Search space (real case data) - Ronald
- Flight envelope -Ignacio
- Environment - Payam

GHENT UNIVERSITY