ATM-UTM interaction in the airport environment use cases from CORUS-XUAM

CORUS-XUAM second workshop

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Founding Members

EUROPEAN UNION EUROCONTROL

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CORUS XUAM

ATM – UTM interaction use cases

- Two use cases are considered
  - Departure of an EVTOL from a vertiport at an airport
  - Arrival of an EVTOL at a vertiport at an airport
- Each occurs in the same context
- The context comes from one of the CORUS XUAM demonstrations

- Assumptions come first
- The context is then presented
- Then the use cases.
- Finally conclusions for the ConOps

EVTOL assumptions

- EVTOL have very limited range and endurance
  - In manned aviation terms they take off in emergency
  - They have limited ability to hold or divert
- Once the U-space operation plan is agreed, the EVTOL can fly uninterrupted to the destination
- UAM operations are in competition with other forms of local/regional transport
- Passenger experience and swift connections to/from airport terminals are crucial for success

CORUS XUAM – WP 7 Urban Air Mobility Very Large Demonstration Project – Germany & UK

DFS Deutsche Flugsicherung

DRONIQ

DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center

NATS

VOLOCOPTER

SUPPORTED BY SESAR JOINT UNDERTAKING

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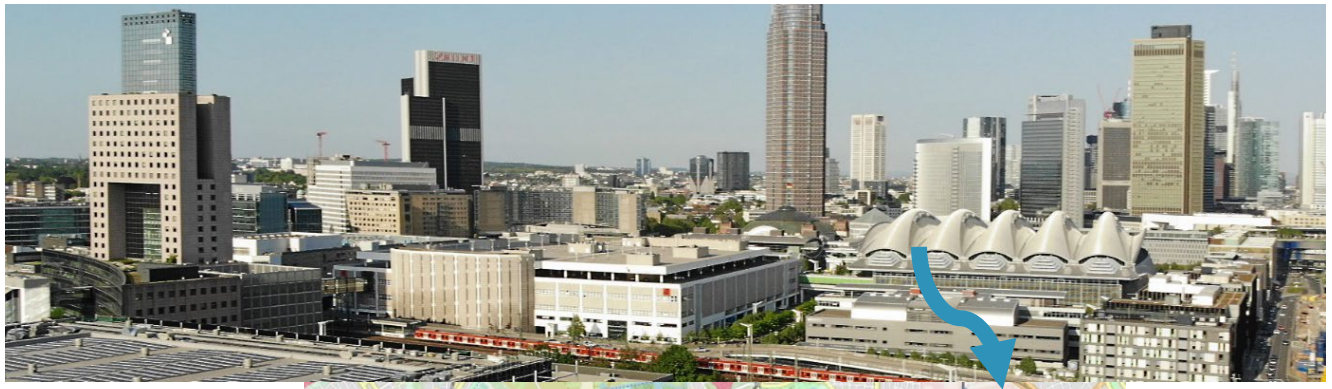
CORUS XUAM – WP 7 Urban Air Mobility Very Large Demonstration Project – Germany & UK

Demonstration of an Air Taxi operation between Frankfurt airport and the Frankfurt exhibition centre*

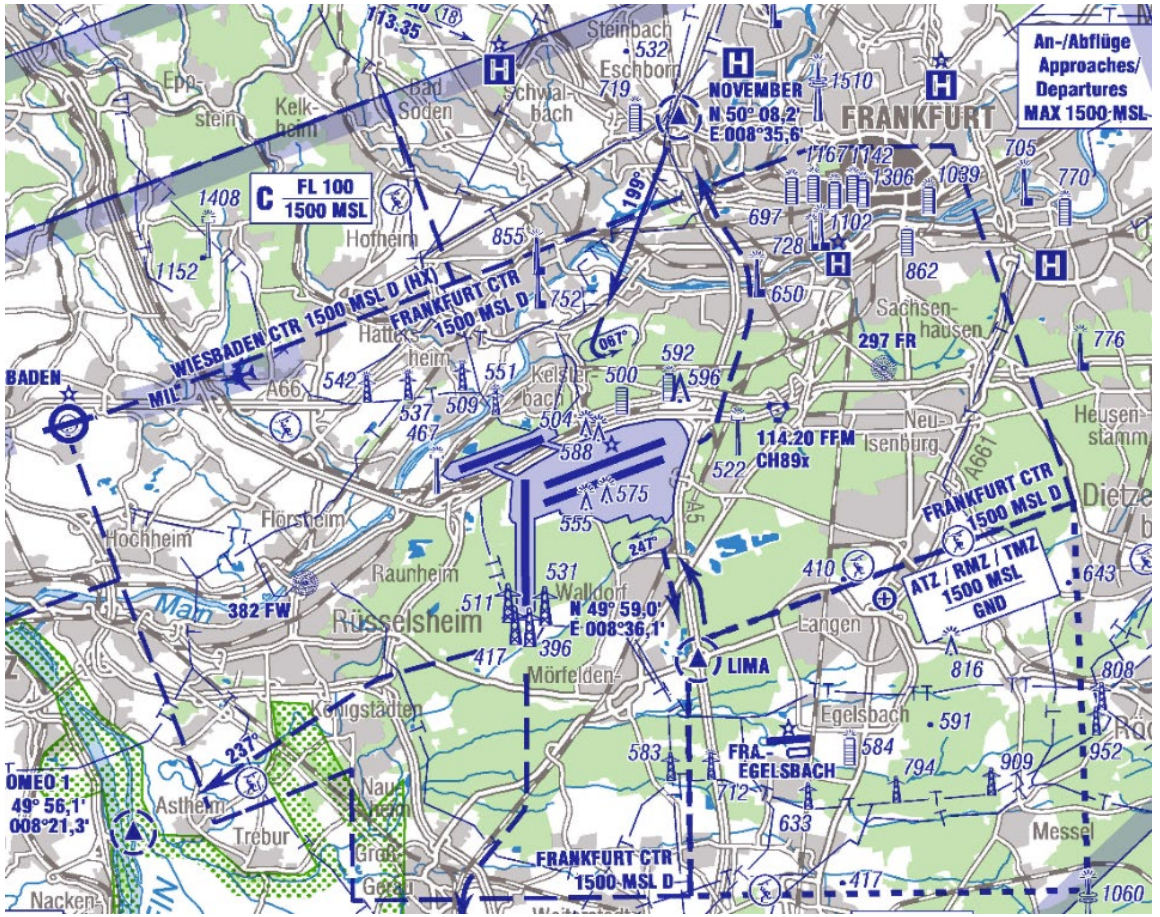
Demonstration date: June 2022



* Actual flight will take place elsewhere, coordinate transformation will be applied.

CORUS XUAM – WP 7: Objectives

1. Demonstrate an integration of UAM in U-Space within existing airspace structure (Class D CTR)
2. Demonstrate procedures between USSP/UTM, ANSP/ATM, Vertiport and UAM operators
3. Demonstrate interoperability between systems
   a) UTM
   b) ATM
   c) Taxi fleet management system
   d) Vertiport management system
   e) UAM vehicle



Route design: Shortest route

- Almost direct between Frankfurt Airport and Frankfurt Messe
- Approximately 9 km
- No conflict with VFR holding pattern and Hospital HEMS operations
- U-Space corridor around the route

Responsibilities of ATC and USSP:

- ATC responsible for keeping other traffic clear of the corridor
- ATC responsible for providing take-off clearances to UAM operation
- Strategic conflict resolution in the corridor by USSP (pre-flight)
- Tactical separation within the corridor either by self-separation or USSP (TBD)

Conflict with traffic approaching RWY 25R

The corridor crosses the final approach of RWY 25R

- ILS GS is approx. at 680 ft AGL.
- Independent crossing below is not an option due to wake-turbulence.
- Independent crossing above is not an option due to potential go-arounds.
- Result will be high controller workload for coordination and loss of capacity at either RWY and/or vertiport.

An independent route

Solution:

Fly east until there is sufficient (>1000 ft) vertical separation from RWY 25R approach.

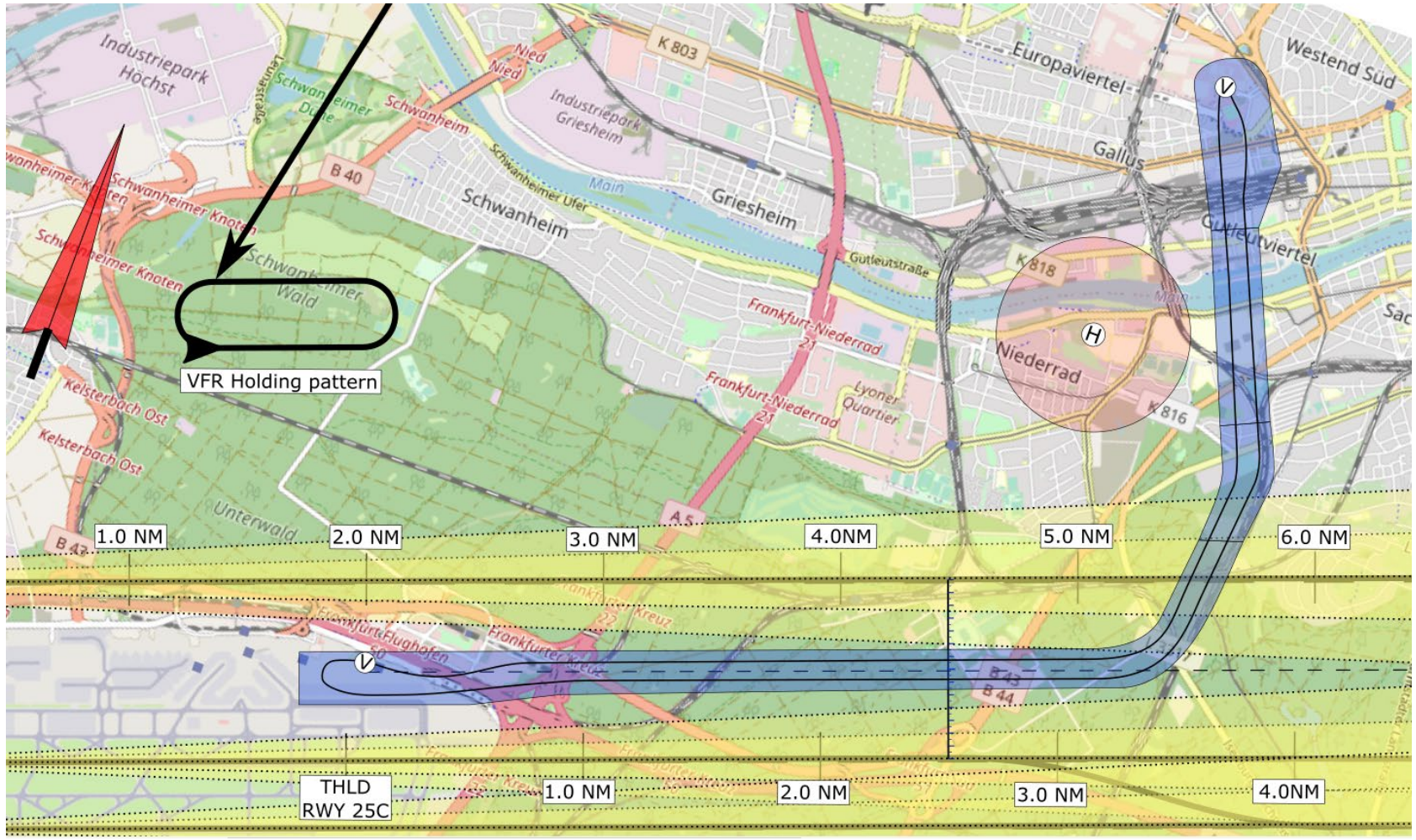
No conflict with existing airport traffic pattern.

Within the corridor:

- Flight height ~ 500ft AAL.
- Two opposing lanes with centerlines ~160 m (0.08 NM) apart.
- Would require RNP 0.02NM (!)
- At such tight spacing, the size of the aircraft start to play a role

RWY 25R and 25C are operating independent parallel approaches.

How to make the safety case for putting an air taxi lane in between independent parallel approaches?

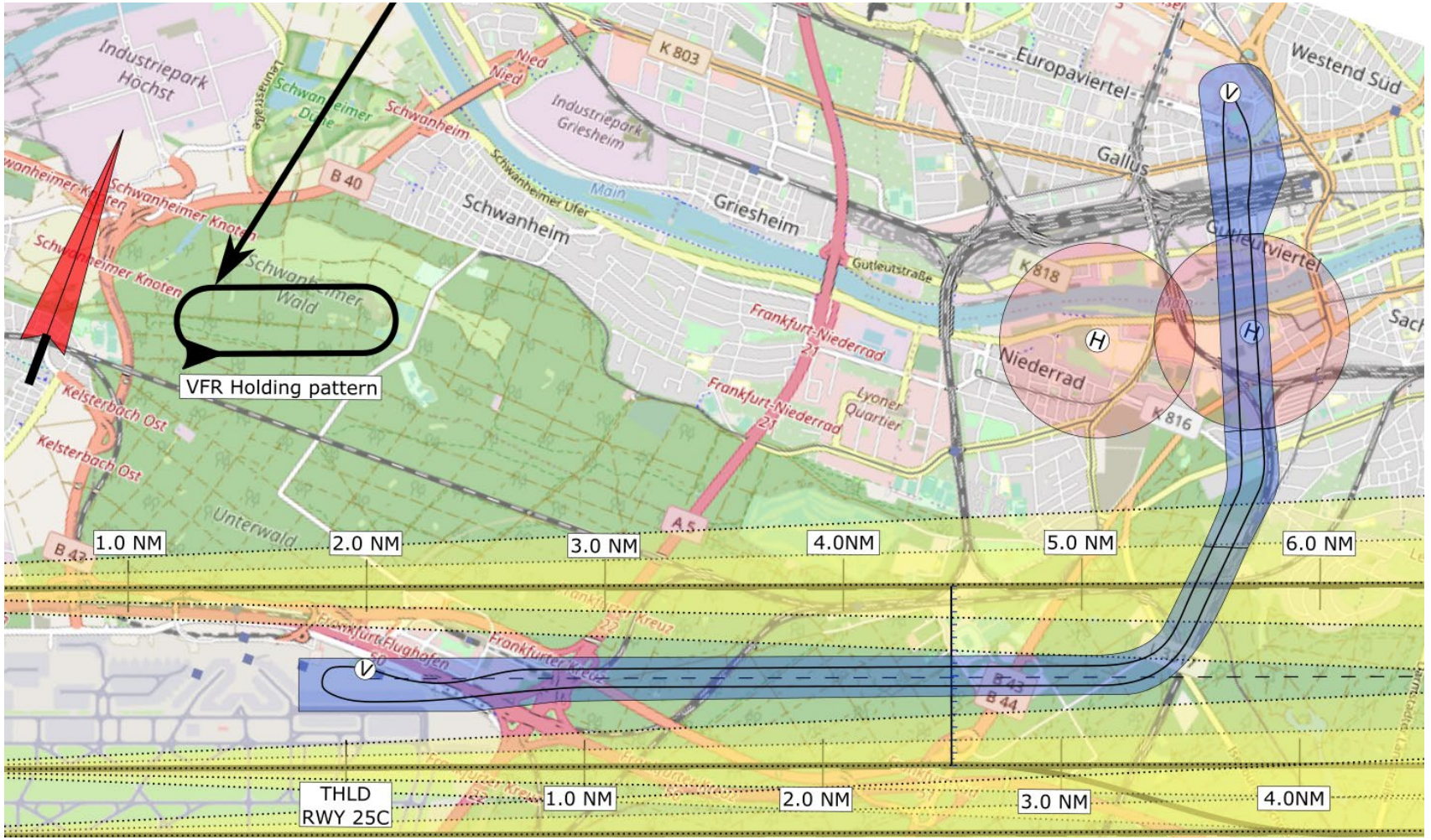


A second Helipad at the Hospital

The hospital has two helipads.

The eastern pad is used most frequently.

Another conflict to solve…



Solution: dynamic reconfiguration of airspace

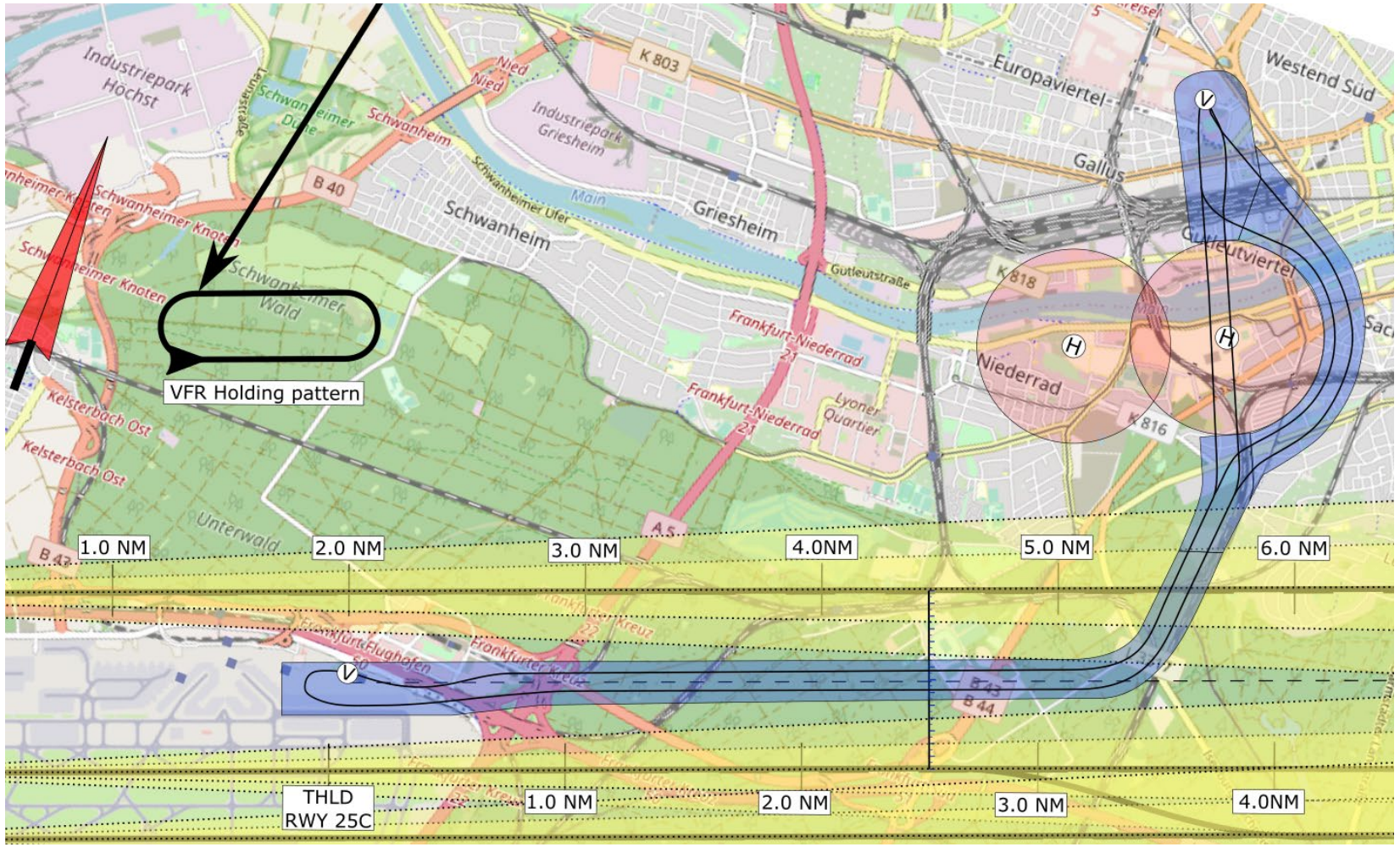
When there is an (imminent) operation at the eastern helipad:

ATC closes the corridor over the hospital and opens the corridor around.

- Air taxis in the closed corridor (or on the verge of entering) will continue as planned and clear the area within 2 minutes.
- Air taxis approaching the closed corridor will take the detour.

Change of clearance distributed by the UTM system.

Interface between Tower Flight Data Processing System and UTM under development.

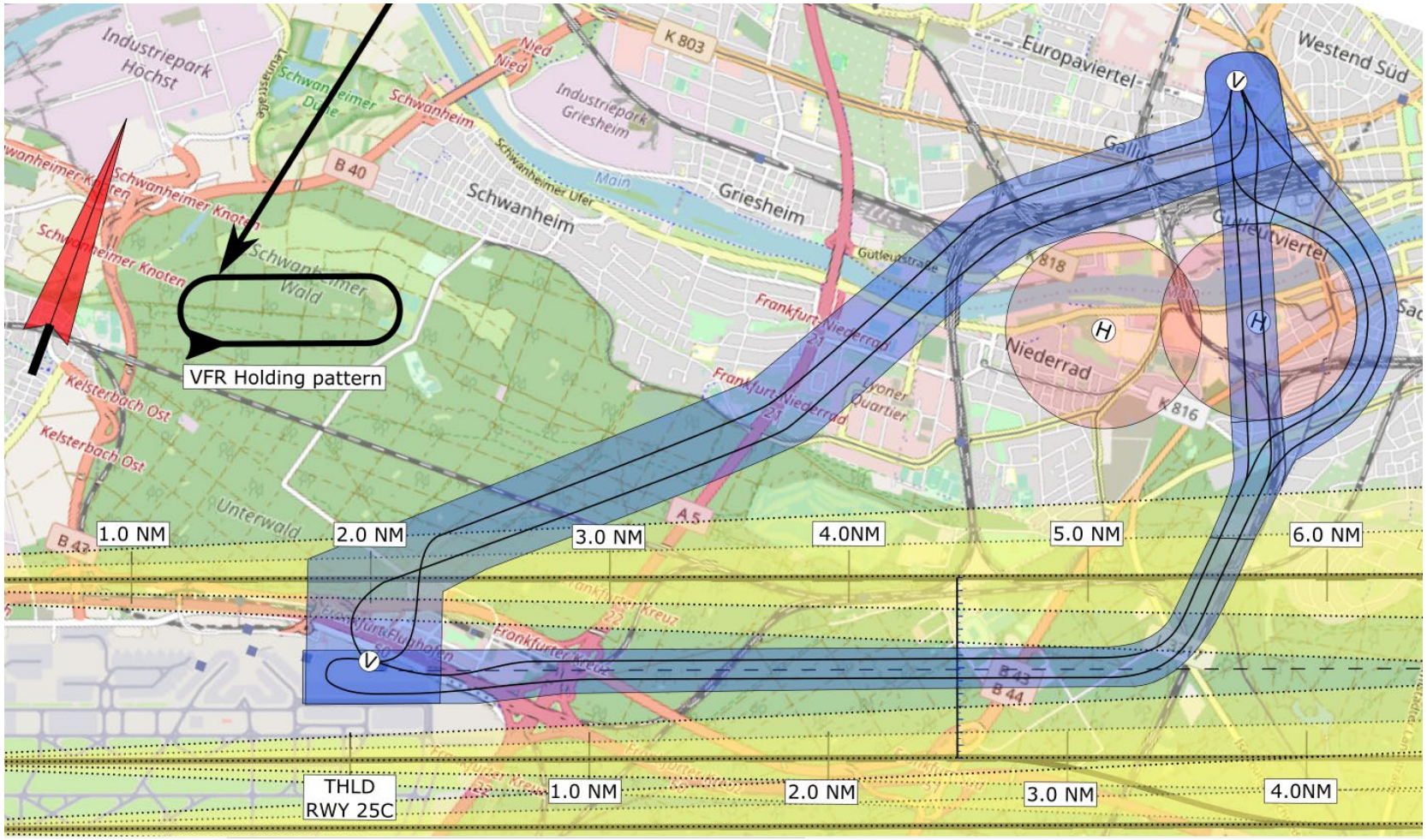


Wrap up of route design

Three preliminary routes have been designed for UAM[1)], each for a different traffic situation.

Strategic conflict resolution will be performed pre-flight. This requires interfacing between the fleet managements system, UTM, ATM and vertiport management system. This is under development.

ATC clearances to UAM and dynamic U-Space reconfiguration are provided by ATC through the UTM system to the UAM operator. A prototype integration of the ATC Tower systems with the UTM system is under development.



1) Designed in context of the CORUS XUAM project. Routes have not been validated by ATC.

ATM-UTM interaction use cases

- The context is **inspired** by WP7, air taxi operations between Frankfurt Airport and Frankfurt Messe
- Use case 1:
  - Air taxi flight departing the airport going to the city
  - Departure to be coordinated with airport movements
  - City is in uncontrolled airspace, U-space Y volume
  - Flight is strategically deconflicted by U-space
- Use case 2:
  - Air taxi flight departing the city going to the airport
  - City is in uncontrolled airspace, U-space Y volume
  - Flight is strategically deconflicted by U-space
  - Arrival to be coordinated with airport movements
  - Air taxi has very limited range & endurance,
    holding & vectoring near the airport should be avoided

Key messages

- Integration of UAM in the airport ground infrastructure
  - Vertiport location, location, location
- Uninterrupted flow of traffic
  - Deconfliction before take-off
- Coordination between Tower & UTM
  - Dealing with uncertainty of manned traffic

Conclusions in terms of the ConOps

- There will need to be coordination of U-space traffic and manned
  - This may involve systems such as DMAN, AMAN, Airport CDM
  - It will also require ATC involvement
- The uncertainties inherent in manned aviation need to be accommodated by U-space
  - U-space should allow a time window for EVTOL departure
    - Within that window the precise moment will depend on the manned traffic
  - Arriving EVTOL may need to adjust their arrival time (i.e. speed) during flight
- These processes need tight coordination between:
- ATC (AMAN, DMAN), USSP, UAS-operator, Vertiport-operator