

*Airborne Integrated Systems for Safety Improvement,  
Flight Hazard Protection and All Weather Operations*

# **FLYSAFE NG ISS Helicopter Requirements**

**25-26 March 2009  
NLR, Amsterdam**

# NG ISS Helicopter Requirements

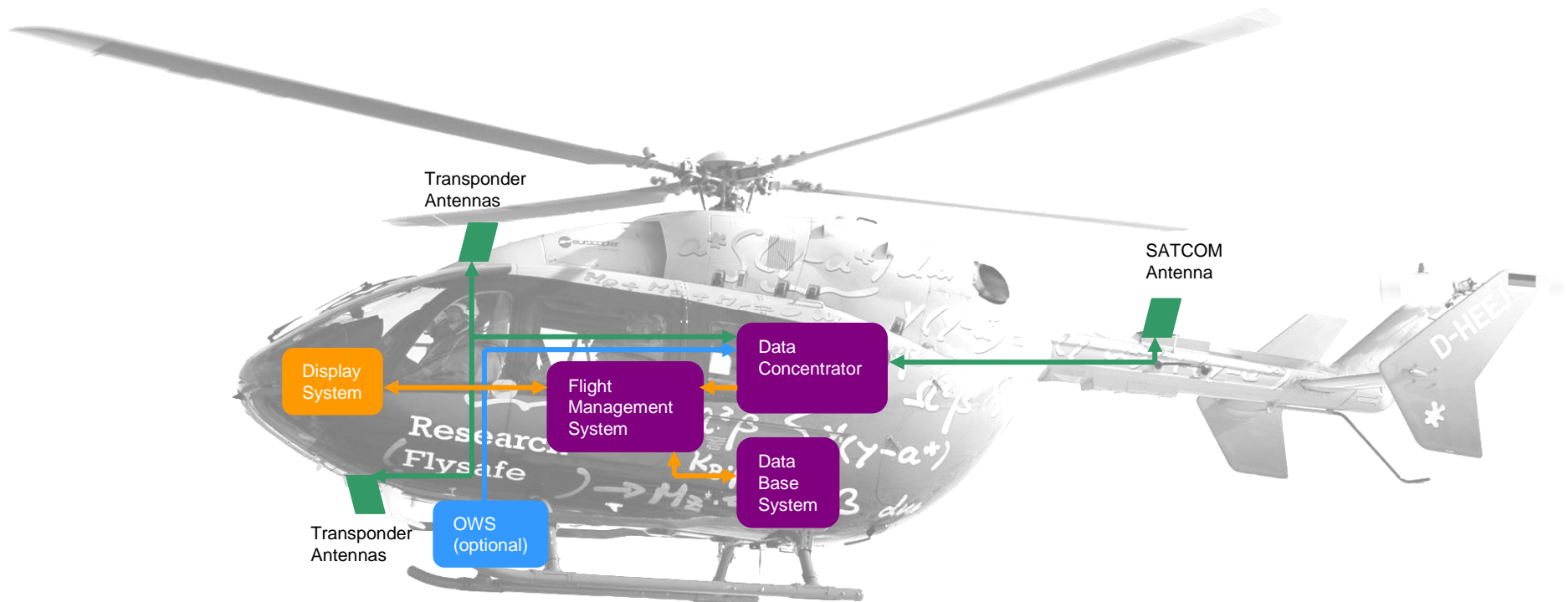
- **NG ISS = New Generation Integrated Surveillance System**
- **The NG ISS for helicopter shall fuse, collect and manage together all information available on-board on flight hazards like:**
  - **Terrain**
  - **Obstacles**
  - **Traffic**
  - **Weather**
- **The NG ISS shall validate and proof the applicability of these hazards regarding the flight safety of the helicopter**
- **The NG ISS requirements for helicopters are different to those from fixed wing aircraft due to:**
  - **Low operation altitudes**
  - **Special missions (HEMS, police, etc.)**
  - **Different avionics and sensors on-board**
  - **Need for high situation awareness (SA) → Specific HMI requirements**

# NG ISS Helicopter Requirements

- **NG ISS for helicopters requires the following information:**
  - Detailed local terrain data (digital elevation model)
  - Detailed and current obstacle data (power lines, towers etc.)
  - Actual traffic data also for low flying and small objects
  - Local current 3D weather data
- **NG ISS required subsystems:**
  - Central data base system (DBS) for
    - ◆ Terrain data
    - ◆ Obstacle data
  - Receiver for current
    - ◆ Weather data (e.g. via SATCOM)
    - ◆ Traffic data (e.g. ADS-B, TCAD, TCAS)
  - Sensors for
    - ◆ Near field obstacle data (optional)

# NG ISS Helicopter Requirements

## ■ NG ISS for helicopters: system overview



# FLYSAFE concepts for NG ISS for helicopters

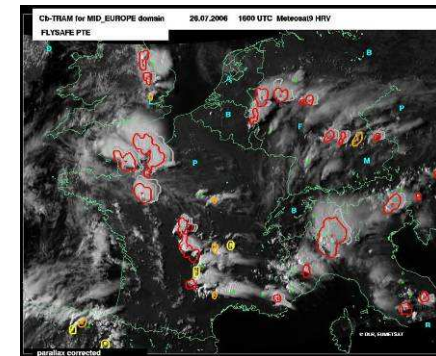
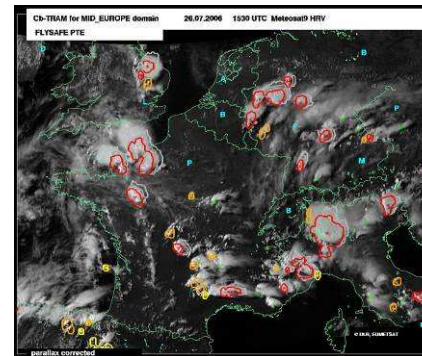
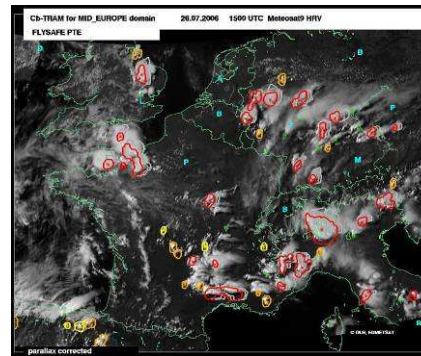
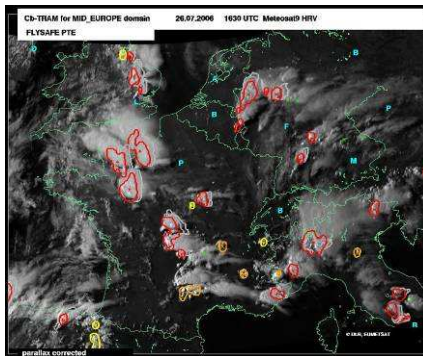
- Eurocopter contributed a research helicopter with free programmable
  - Flight management system (FMS)
  - Display system with 3D Synthetic Vision System (SVS) and 2.5D map (NMD)
- In both displays presentation of
  - Terrain
  - Weather
  - Air Traffic
  - Obstacles
  - Airspaces
- In FLYSAFE the main focus was given to
  - Weather (WIMS) data presentation including data chain via SATCOM
  - Traffic data presentation



NMD and SVS

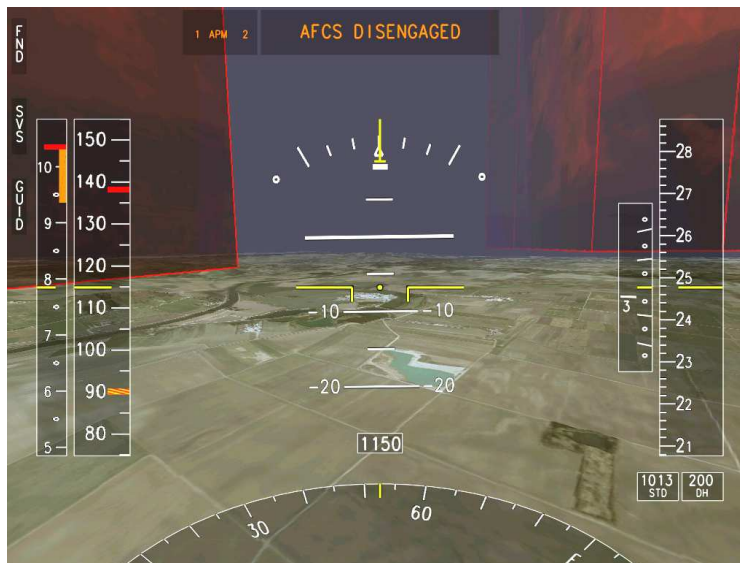
# Information from METEO server: Data Chain

- **WIMS data are sent to the helicopter (polygons and criticality)**
- **A SATCOM data link was used on the helicopter (INMARSAT service)**
- **The weather data are collected in the on-board data server and forwarded to the flight management system (FMS)**
- **The weather data are presented on**
  - **The Synthetic Vision System (SVS) in the PFD (three-dimensional)**
  - **The Navigation Management Display (NMD) (two-dimensional)**
- **The weather data can be used for planning and monitoring inside the FMS**

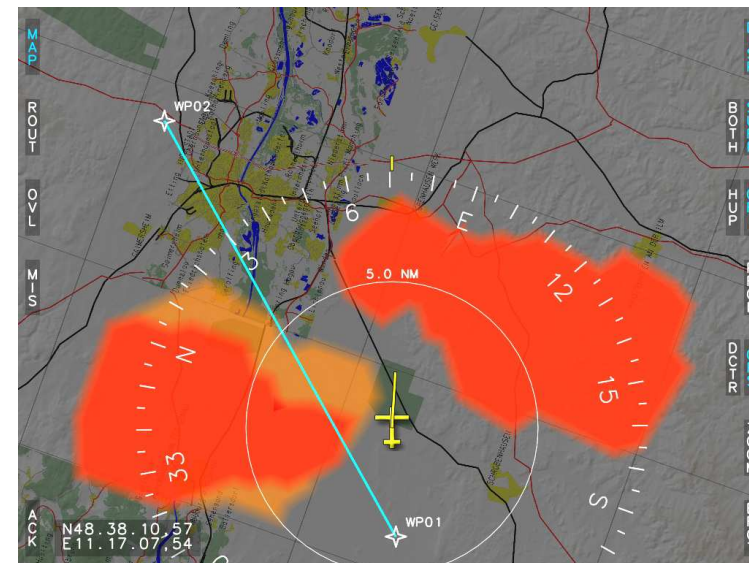


# Weather Data Presentation in the Helicopter

- Weather data Presentation on the
  - Synthetic Vision System (SVS) in the PFD (three-dimensional)
  - Navigation Management Display (NMD) (two-dimensional)
- 2 colors for two criticality levels (received from WIMS server)
- Polygons are fading out



**Polygon boxes in the SVS**



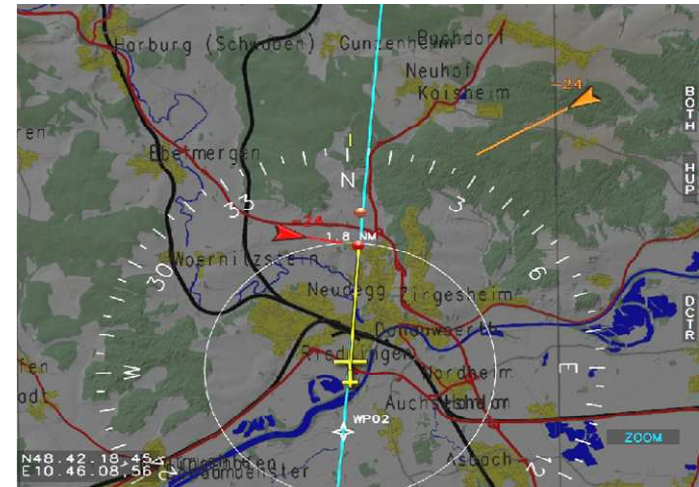
**Polygon areas in the NMD**

# Traffic Data Presentation in the Helicopter

- Traffic data Presentation on the
  - Synthetic Vision System (SVS) in the PFD (three-dimensional)
  - Navigation Management Display (NMD) (two-dimensional)
- Arrows show flight direction; flight vector represents extrapolated position in 3 seconds
- 4 colors for four criticality levels (received from traffic data server)
- Criticality level 3 and 4: calculated collision point displayed



Arrow symbol in the SVS



Arrow symbols in the NMD

- The weather data presentation was evaluated in a FLYSAFE simulator assessment in Ottobrunn at EUROCOPTER facilities (09.12.2008)
- FLYSAFE partners had been invited
- 2 EC reviewers participated
- 3 pilots performed the assessment

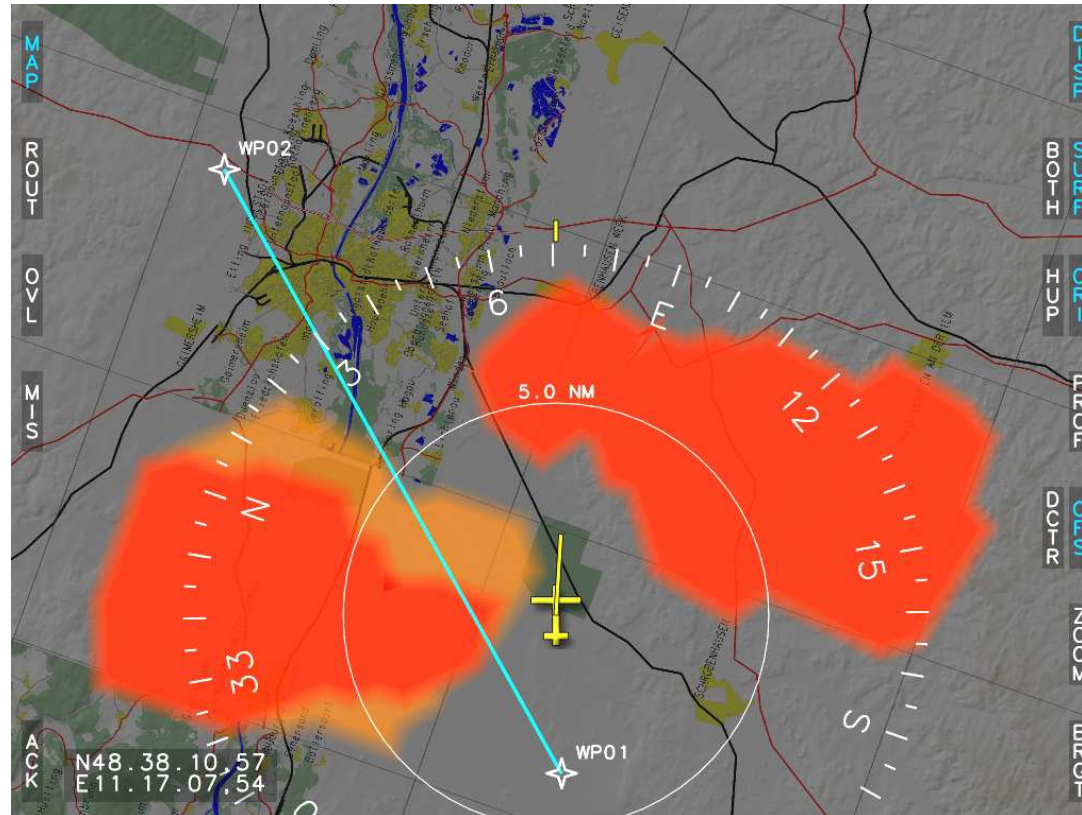


■ Evaluation in the helicopter simulator and development cockpit

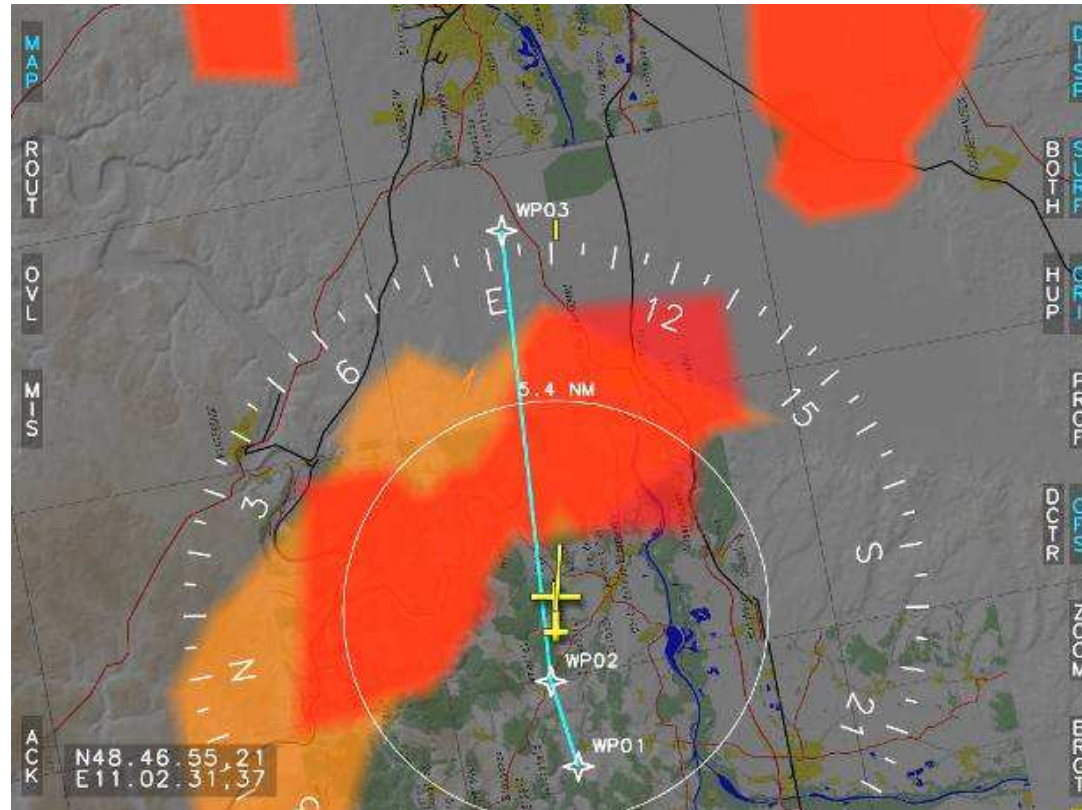


- **9 Predefined scenarios had been prepared and evaluated:**
  - **Scenario 1-4: weather scenarios**
  - **Scenario 5-8: traffic scenarios**
  - **Scenario 9: combined weather and traffic scenario**
  
- **Pilot had to reach a destination as fast as possible (no fixed route) and avoid weather hazards and other air traffic**
  
- **Useful comments from 3 pilots**
  
- **Task of all Scenarios: the pilot had to start at WP01 and fly via WP02 to WP03 as fast as possible. When reaching WP02 the weather or traffic scenario was switched on. Now the pilot has to react immediately on the new situation**

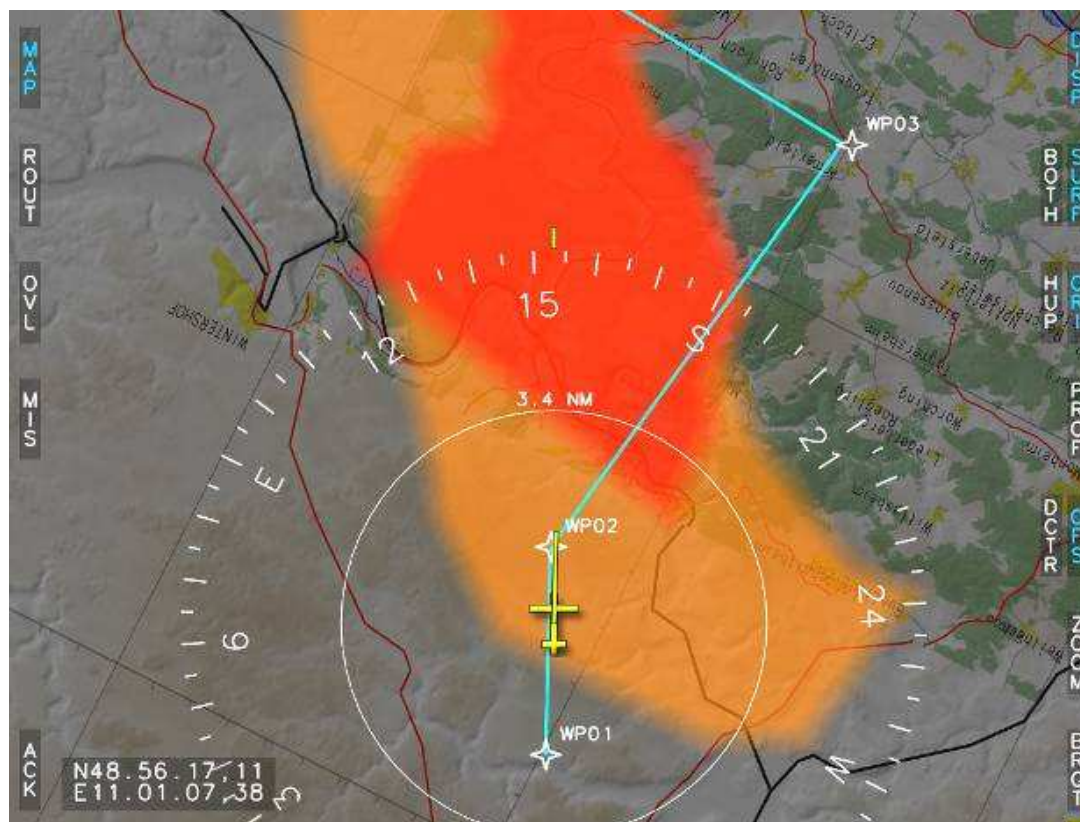




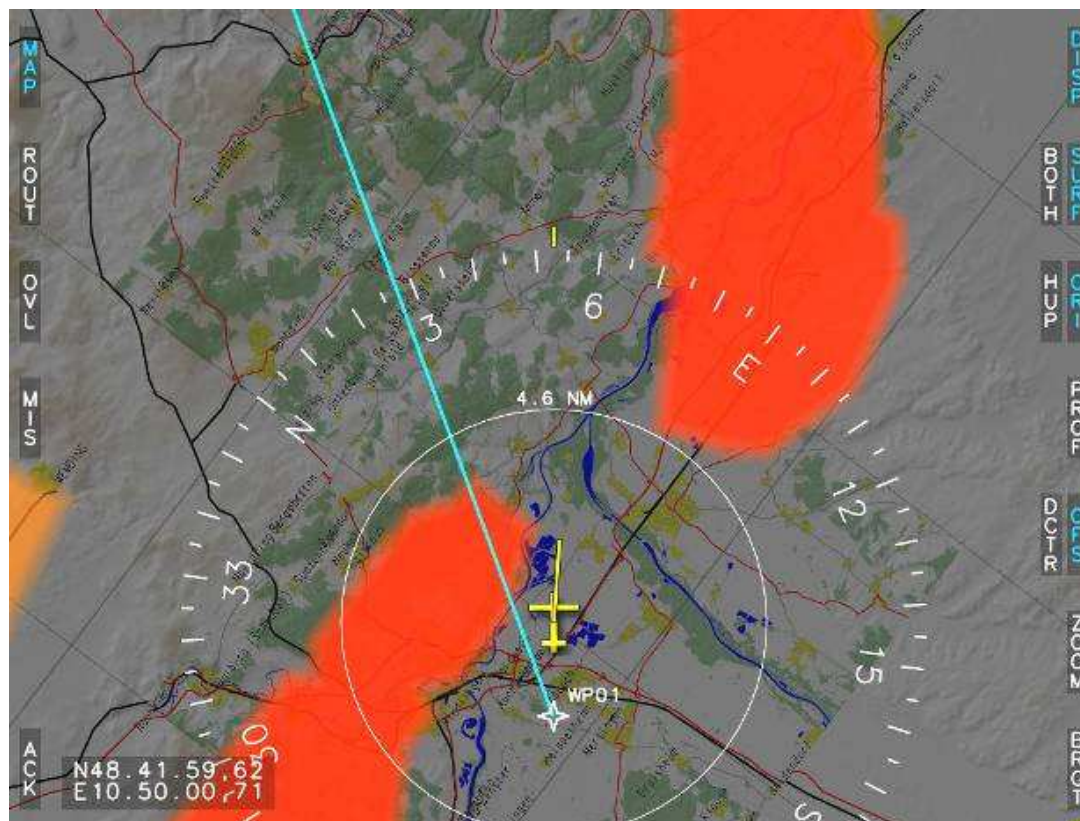
- **Scenario 1:** Learning-scenario for weather presentation; the objective was to fly around the amber and red areas. The amber and red colours represent the different criticality levels of the weather. This scenario was used to get a feeling for the NMD and PFD weather presentation.



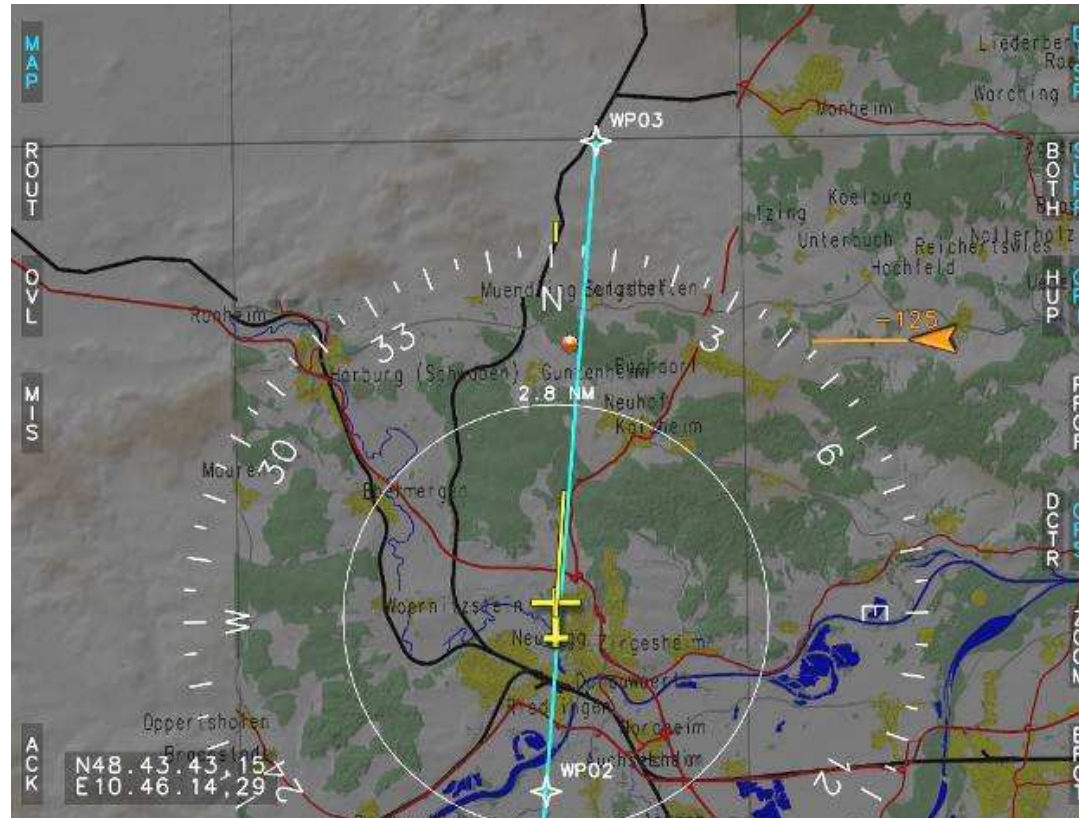
- **Scenario 2:** A closed cloud-system popped up when reaching WP02, which prevented the pilot using the shortest connection (depicted here as the cyan route) to WP03. The pilot had to fly around the weather area.



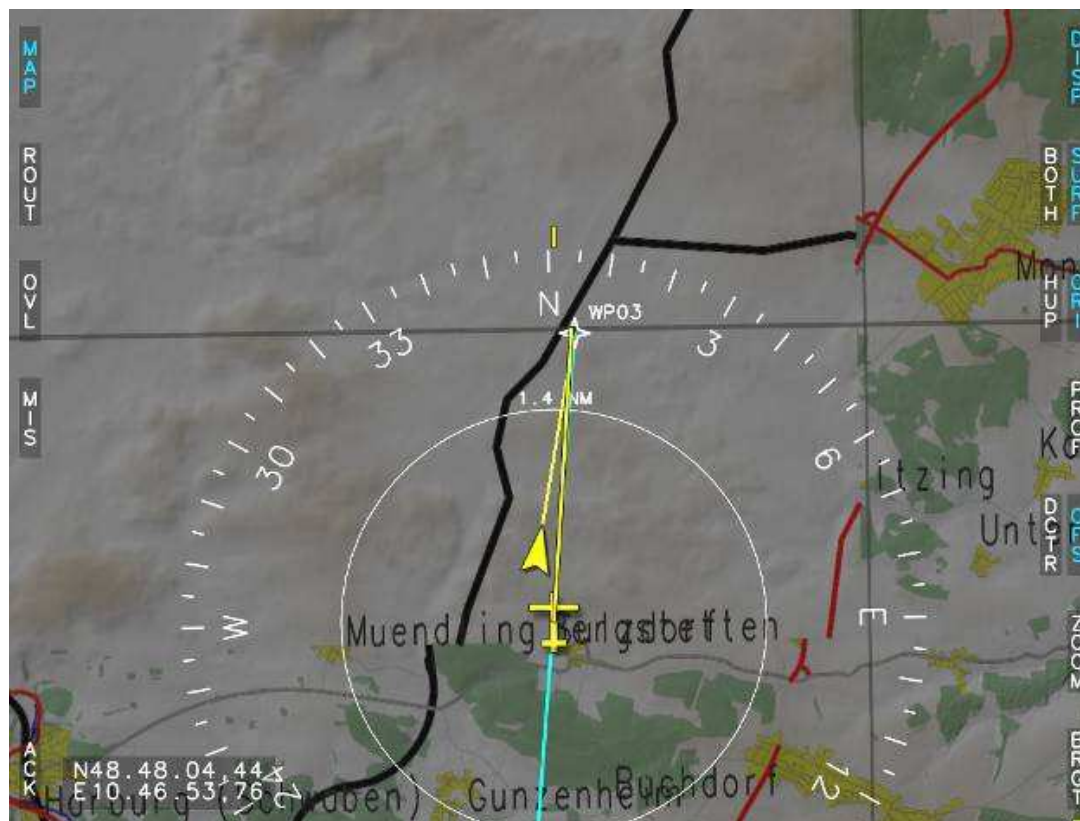
- **Scenario 3:** The pilot was forced to fly inside the amber area, finding himself at WP02 inside a weather area with criticality level 'hazardous' (amber). His task was, to leave the amber area as fast as possible and reach the WP03 outside the amber and red areas.



- **Scenario 4:** The pilot was offered a scenario of clouds with an apparent passage way to avoid the red areas. After a few minutes of flight, a new weather report was simulated in which the open passage way was suddenly closed off and the pilot had to re-plan his route.



- **Scenario 5:** Traffic scenario with one traffic encountering from right-hand side. The pilot was asked to continue on the route with constant speed and altitude so as to go through all the stages of the traffic threat and see the changes in appearance of the traffic.



- **Scenario 6:** Traffic scenario with one aircraft flying nearly in the same direction as the own helicopter. The pilot was again asked to continue on the route with constant speed and altitude to get a feeling for the situations in which the traffic threat would change appearance.

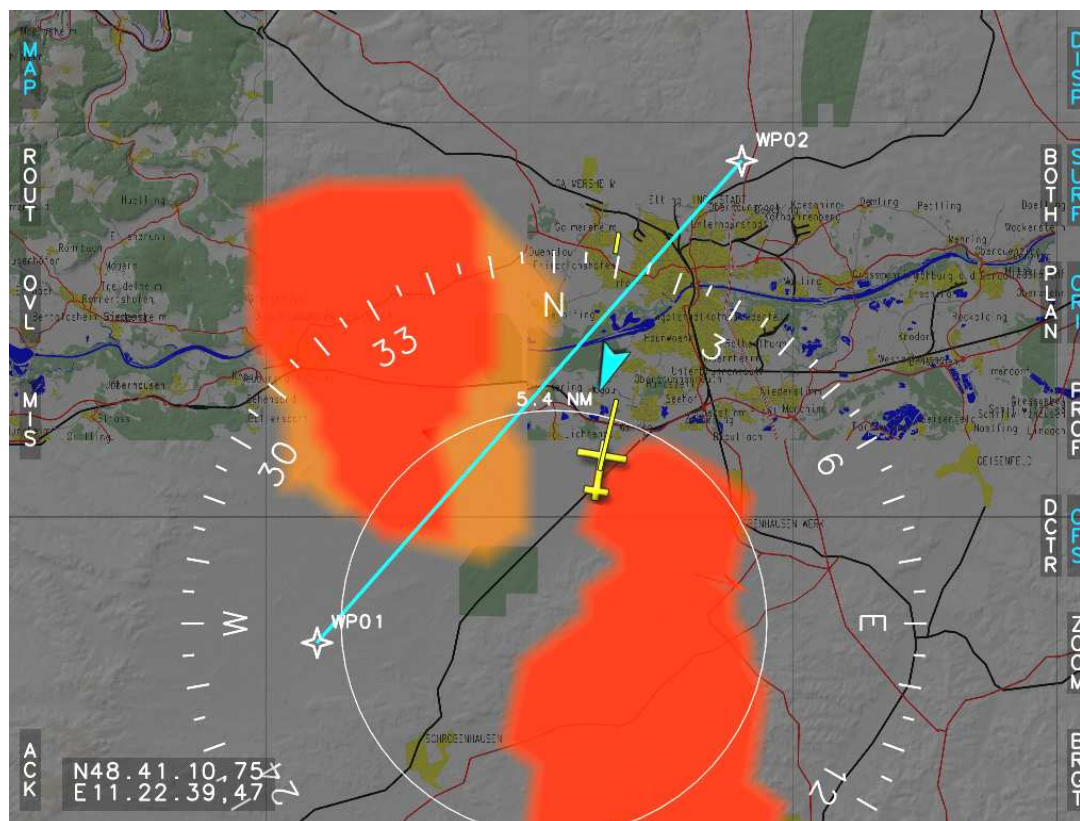


- **Scenario 7:** Traffic scenario with two other aircrafts coming from the left-hand and right-hand side. The pilot was asked to relieve the situation by changing his heading but not his altitude.

## WIMS Data on the NMD



- **Scenario 8:** Traffic scenario with three other aircraft, two of them encountering the own aircraft and one flying parallel and so preventing the pilot escaping to the left. The pilot was again asked to relieve the situation by changing his heading but not his altitude.



- **Scenario 9:** Combined scenario: after some time of flying a seemingly simple “through the passage way between the clouds” scenario was presented. Suddenly another aircraft was introduced which, after a while, started going through the passage way from the other direction.

- The HMI assessment and the flight test showed and proved solutions, to implement a NG ISS onboard a helicopter taking into account the special helicopter requirements!

