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

FLYSAFE
Helicopter Flight Tests
Initial Results

25-26 March 2009
NLR, Amsterdam

Helicopter Simulation and Flight Tests

- The helicopter specific NG ISS was realized and tested
  - First: in simulation
  - Second: in flight test

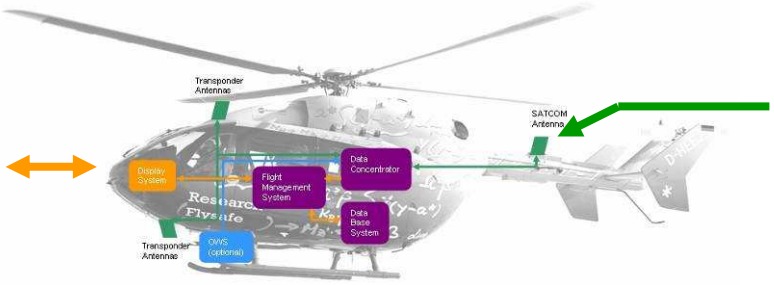
- FLYSAFE helicopter simulator session in Ottobrunn, 09-12-2009
  - Evaluation of HMI for
    - Weather threats
    - Traffic threats

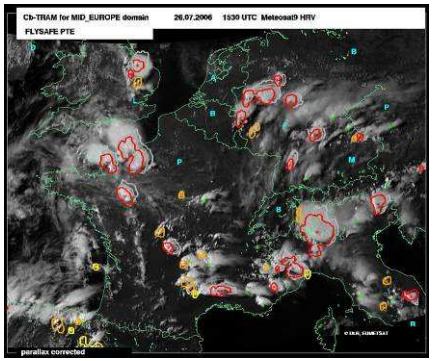
- FLYSAFE helicopter final flight test in Donauwörth, 18-02-2009
  - Evaluation of
    - SATCOM data link for WIMS data
    - System aspects incl. presentation of WIMS data in the cockpit

Simulation & Flight Test: Data Chain for Weather Data

- WIMS data are sent to the simulator/helicopter (polygons and criticality)
- A SATCOM data link was used on the helicopter (INMARSAT SWIFT64 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

Cockpit set-up

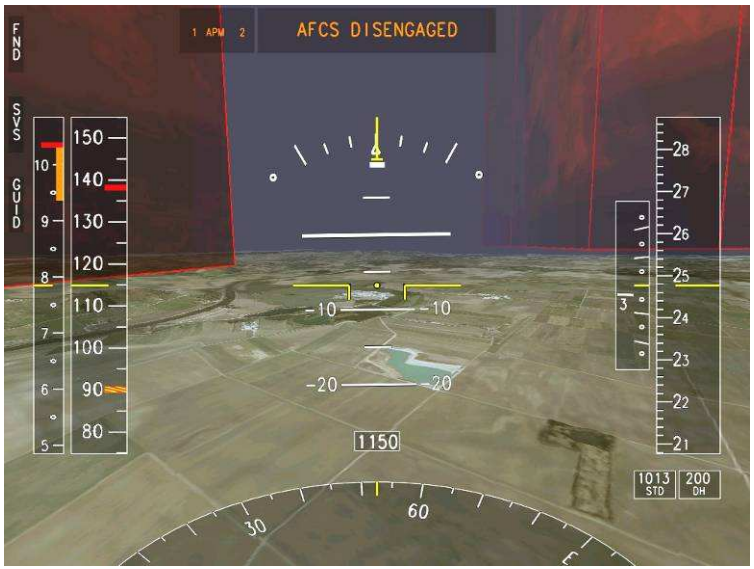




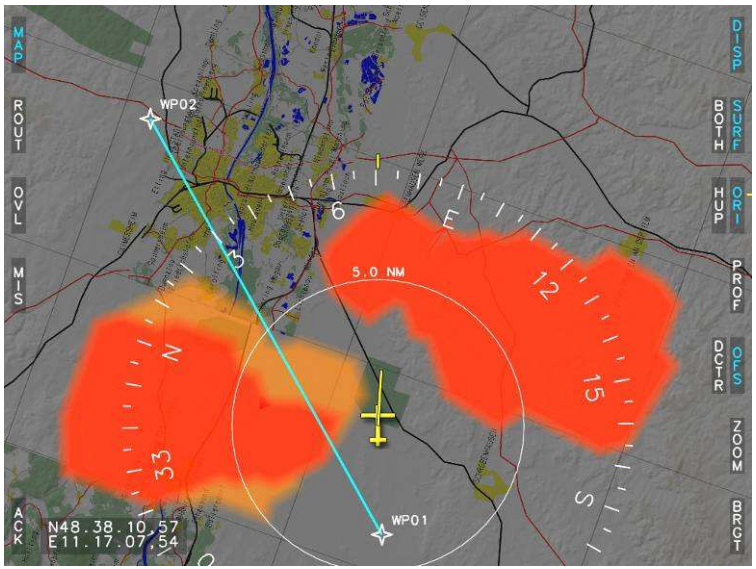
WIMS data

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

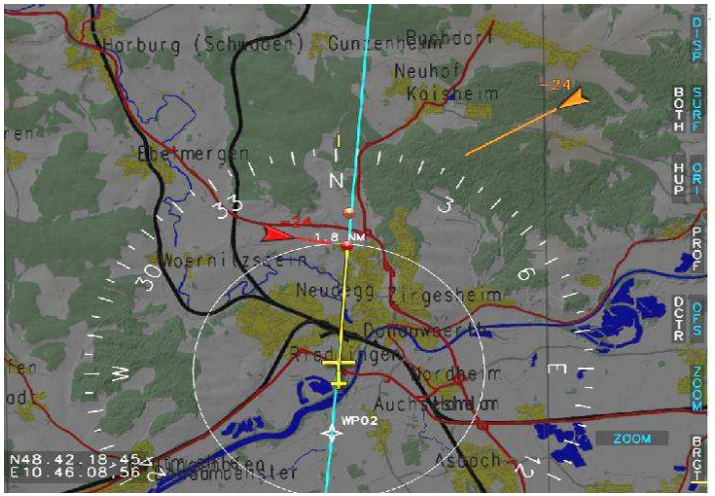


Polygon areas in the NMD

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

Installation of HighSpeed SATCOM on the H/C

- **HighSpeed SWIFT64 SATCOM (Thrane&Thrane) installed on the helicopter:**
  - **Tracking SATCOM antenna**
  - **Antenna preamplifier**
  - **SWIFT Modem/Receiver**

- **Reception of WIMS data**
  - **Weather data set is predefined/simulated for Donauwörth**

SATCOM antenna on the tail boom

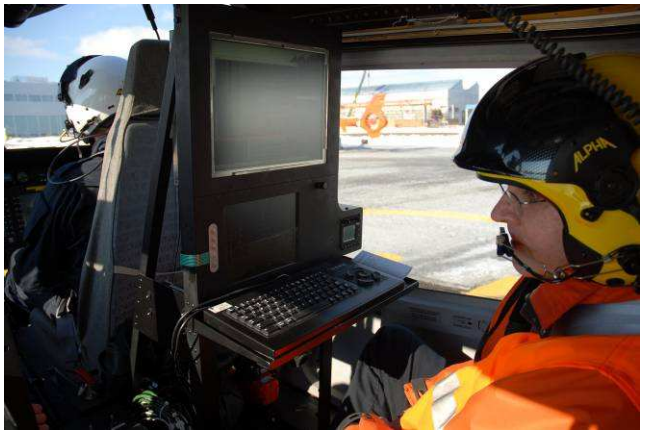
SATCOM equipment in a rack (right)

Installation of HighSpeed SATCOM on the H/C

- **Crew set-up in the helicopter**
  - **1 pilot and 1 flight test engineer in the cockpit**
  - **1 operator**
  - **1 observer**

Cockpit view

EC145 Research Helicopter

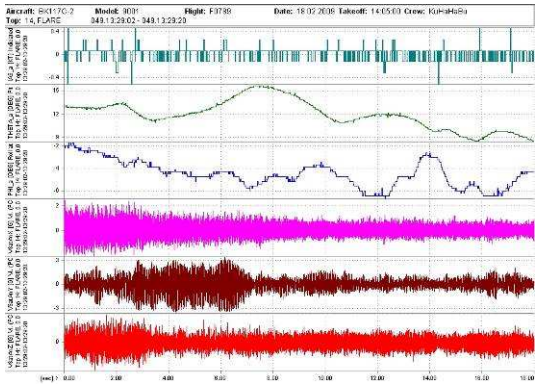


Operator station

Flight Test Program

- Installation of SATCOM antenna
  - Shake-down flight with SATCOM antenna
  - HIGE, HOGE
  - Level flight 60kts, 100kts, sideslip left&right, 360° level turn with 30° bank
- Quality of SATCOM datalink
  - Strait level flight 60 kts and 100kts
  - Strait level flights in N, E, S, W with 100kts
  - 360° level turn with 30° bank, left&right, 100kts
  - Measure data rate and check for interruptions
- Data chain into cockpit diplays
  - Check data reception on request from operator station
  - Check weather data overlay in NMD and SVS

Flight Test Program: Results



Vibration levels during Flare

- Installation of SATCOM antenna
  - All TOPs measured:
    vibration levels at antenna in x, y and z
- Quality of SATCOM datalink
  - 100% data received during all tests!
  - Average time between request and complete delivery: 15.8s
  - Average time between request and start of delivery: 8.9s
  - Average time for WIMS data flow: 6.9s
  - Average net data rate: 14.1 kBit/s (max. 25.4 kBit/s, spec. 64 kBit/s)
- Data chain into cockpit diplays
  - All data received well by display system!
  - Good visibility of weather data overlay in NMD and SVS

Flight Test Program: Results

- **WIMS weather data received via SATCOM during testflight**

EC145 landing after flight test

Weather data presentation in the cockpit

SATCOM antenna on EC145

Flight Test Program: Results

- **Short video sequence of flight test: successful flight test!**