FLYSAFE
Bird strike risk mitigation in aviation

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Aviation Safety Directorate

Wildlife Hazard Management

Royal Netherlands Air Force

65 YEARS

BELGIAN AIR FORCE

Royal Netherlands Air Force

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Presentation overview

Bird strikes
- the problem, on airfield<->en-route, civil<->military

Prevention
- on airfield<->en-route, radar detection

FlySafe project
- common user requirements
- bird mobility, prediction

Follow-on
- Pre-operational service centre, FlySafe-2

Effects of bird strikes: RNLAF 2004/2006, N=164

Loss of mission time

- Aborted take-off 10
- Precautionary landing 27
- Returned to base 50

Damage to aircraft

- 15% of BS result in damage

Aircraft grounded

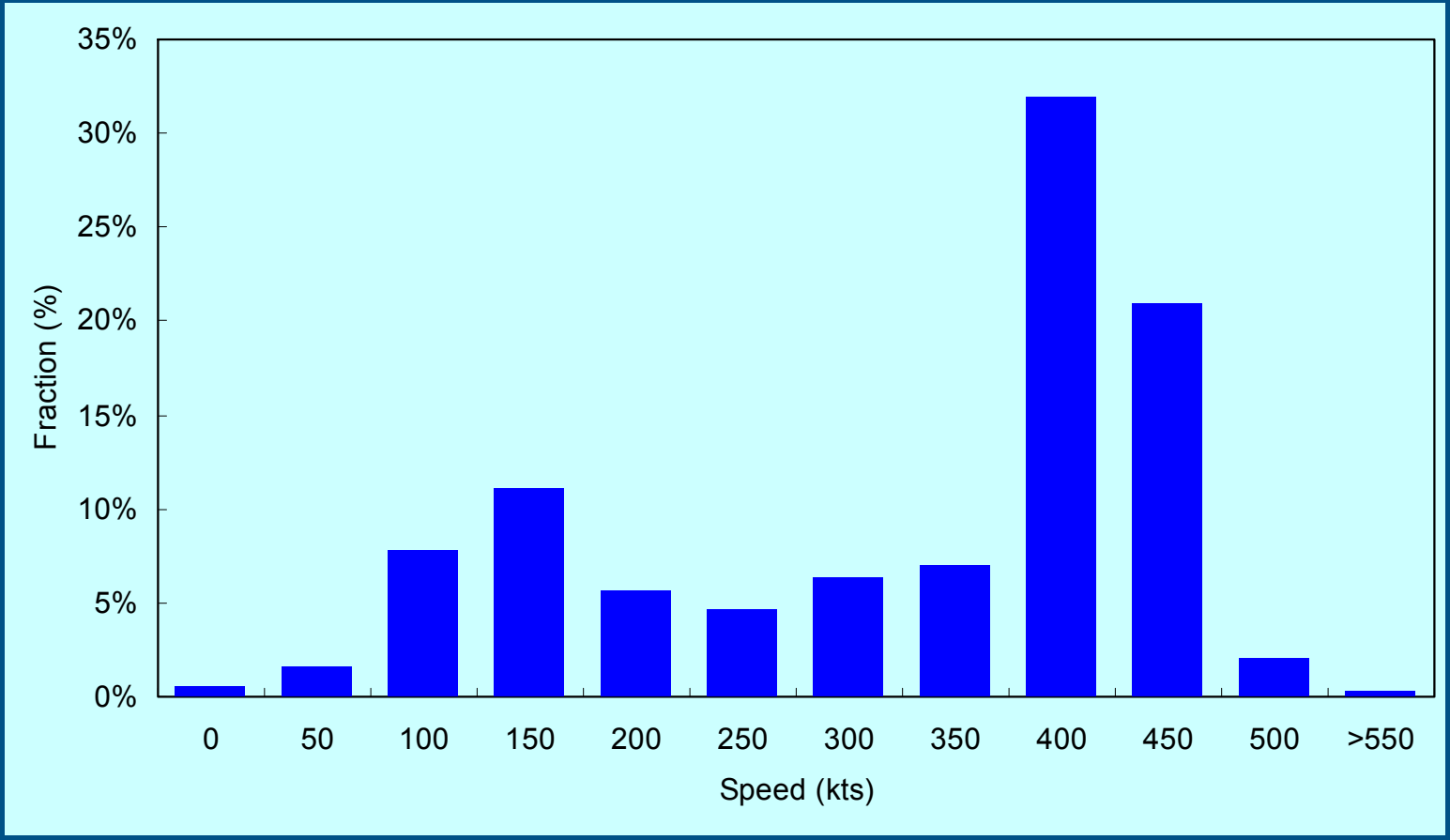
- from 1 hour to 91 days

Loss of aircraft

- 1 F-16

The nature of bird strikes

Bird strikes with jet fighter aircraft over speed EURBASE N-17,732



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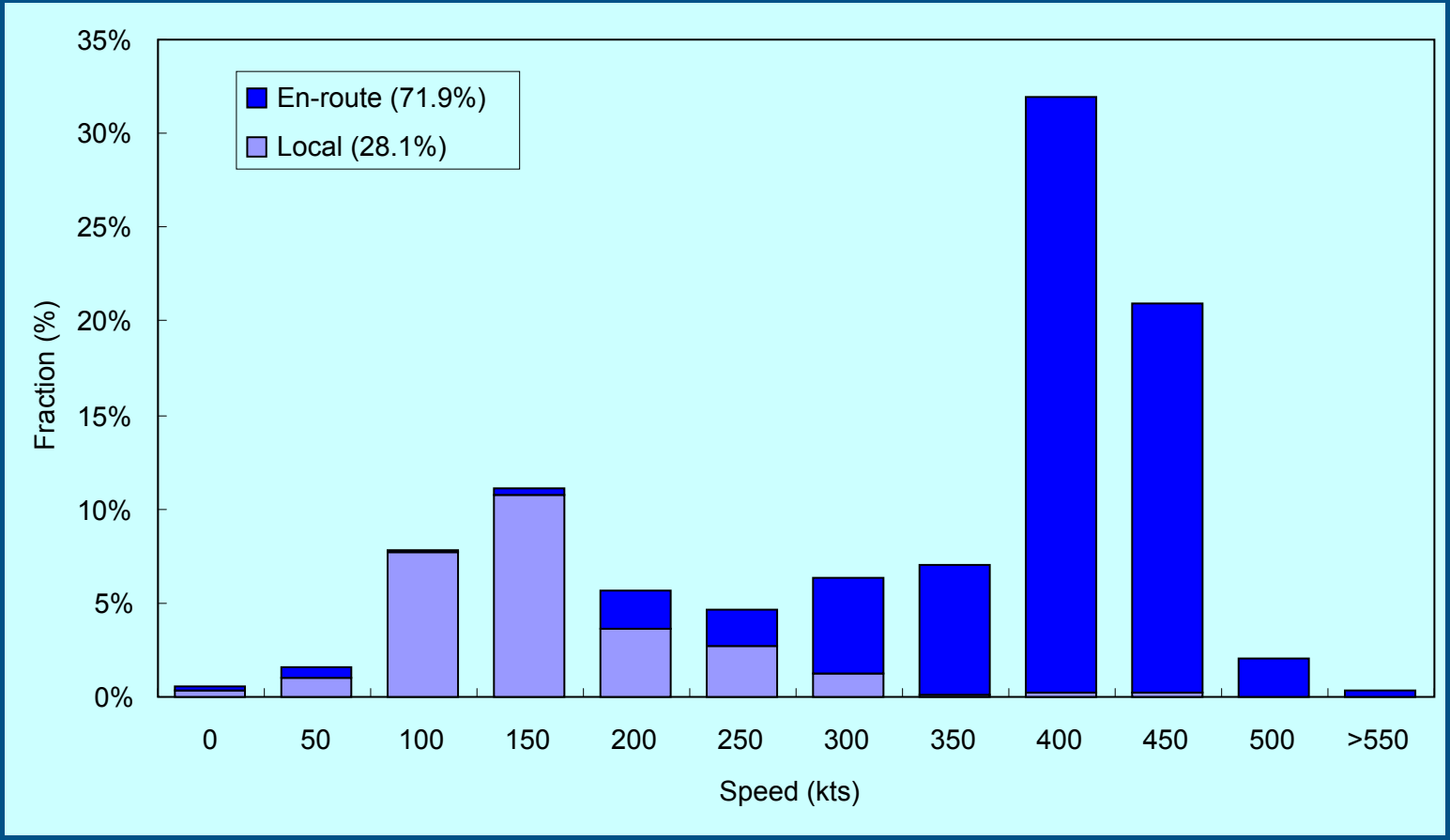

The nature of bird strikes

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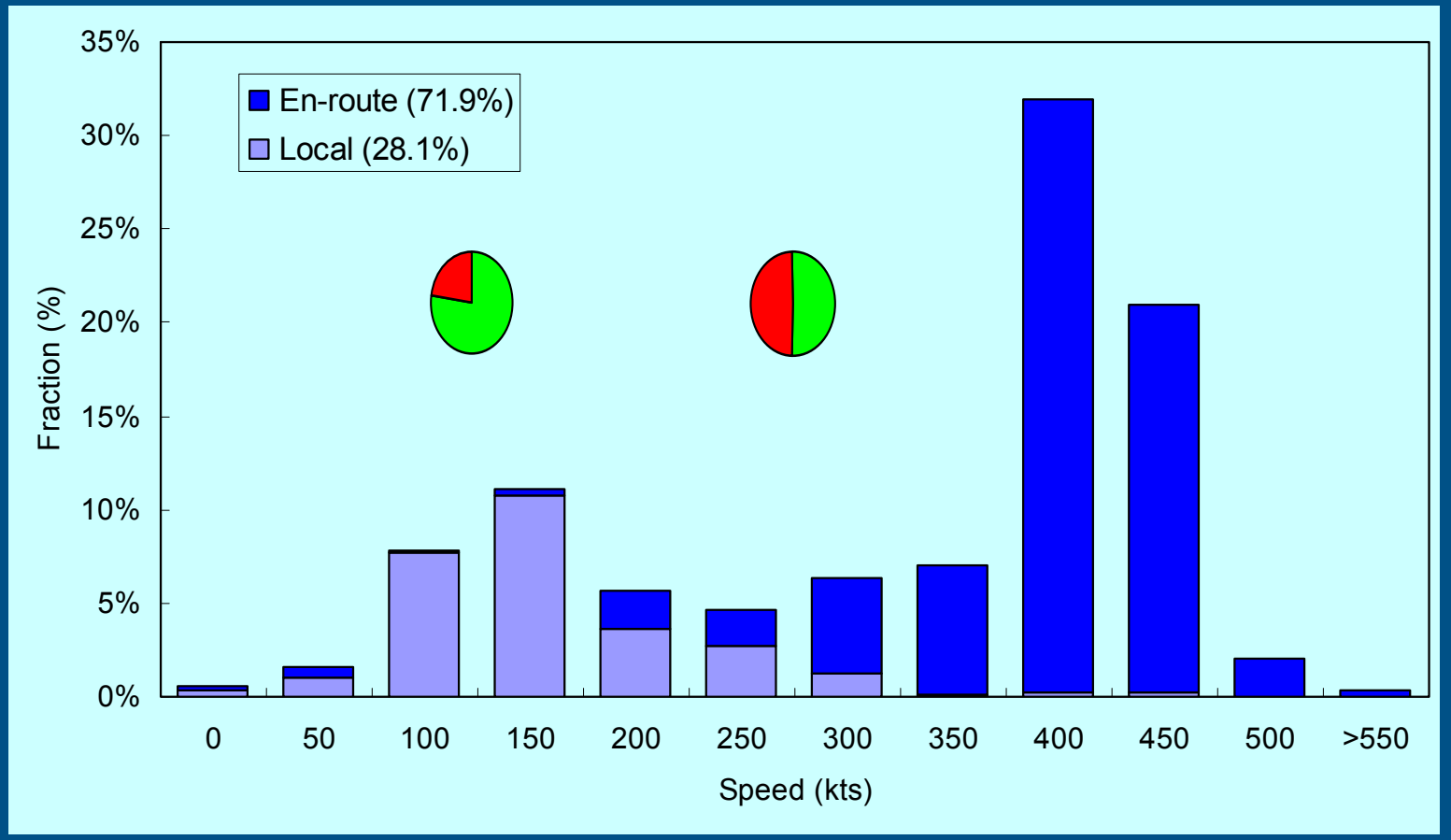


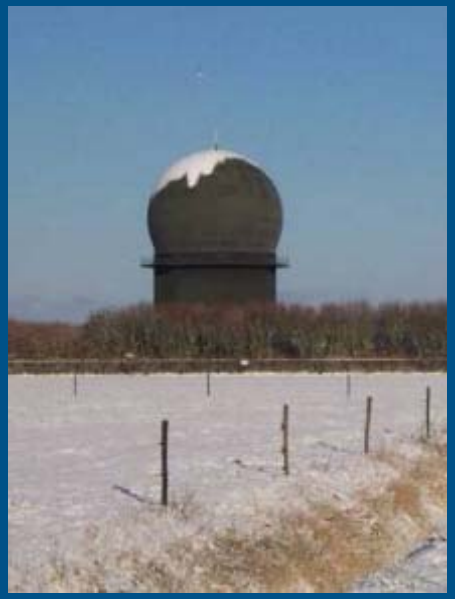
Bird Strike Prevention

On-airfield, keep birds away from aircraft by
- habitat management
- active harassment

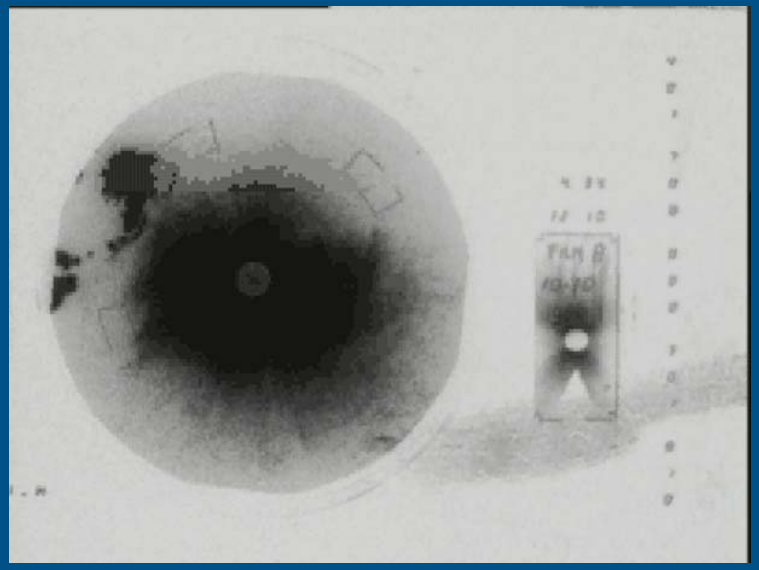
Civil en-route:
Aircraft fly above birds, not relevant

Military en-route, keep aircraft away from birds
- radar detection of high bird intensities
- operational restraint

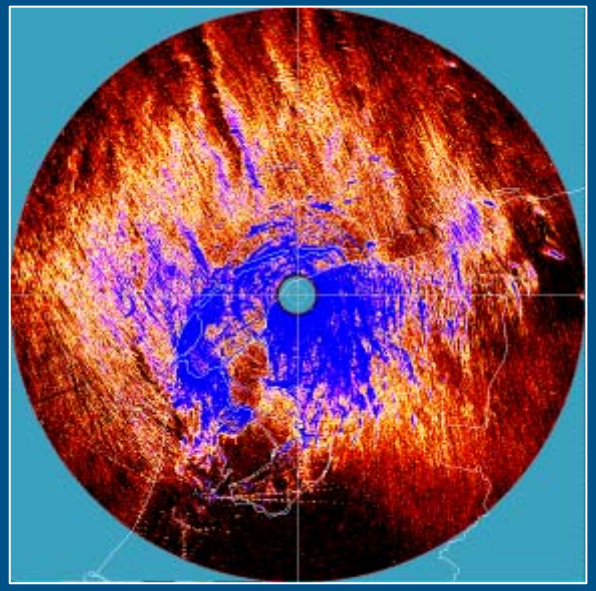
Existing radar knowledge / experience: the starting point for FlySafe



10 cm pulse
Single bird 65 Km
Flock 120/150 Km

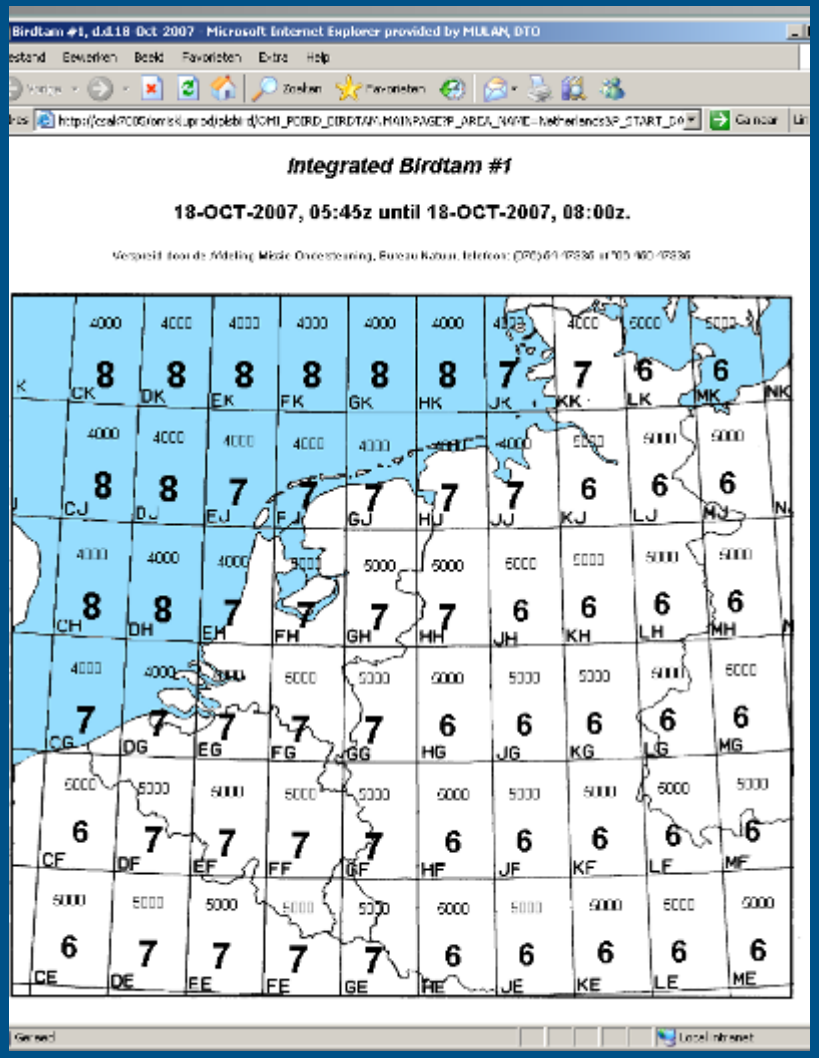


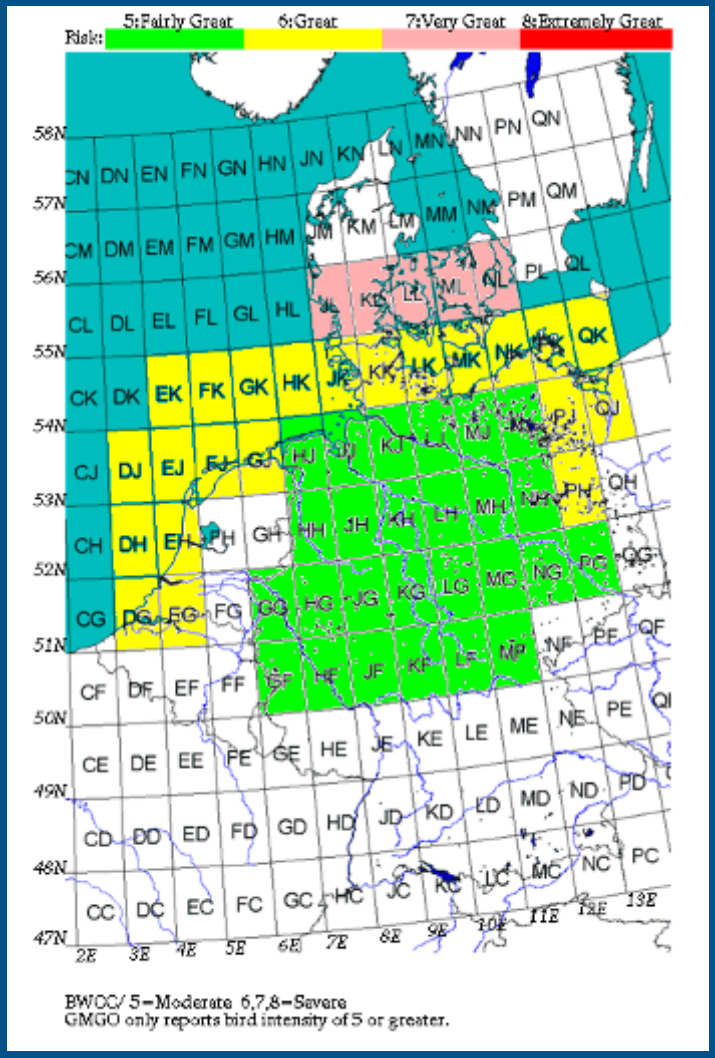
Time laps film October 1980
Dawn effect



Electronic extraction of bird echoes by ROBIN system

BIRDTAM used by pilots in operational environment





Integrated Applications Promotion (IAP) Initiative

Focus on bird mobility in relation to:

- **Human + Livestock Health**
  - Avian borne diseases
- **Migration Ecology**
  - Scientific interest
- **Conservation + Education**
  - Hotspots + Flyways
- **Flight Safety**
  - Bird Strike Problem

FlySafe project partners

The FlySafe project as an opportunity

- Offering a birds eye view from space, including:
  - Connection of international expert communities
  - Experience in a multi user and multi discipline approach
  - Combining technologies in complex integrated systems
  - Satellite information on bird mobility, enabling forecast modeling
  - Remote sensing data (weather and landscape) essential for forecast modeling

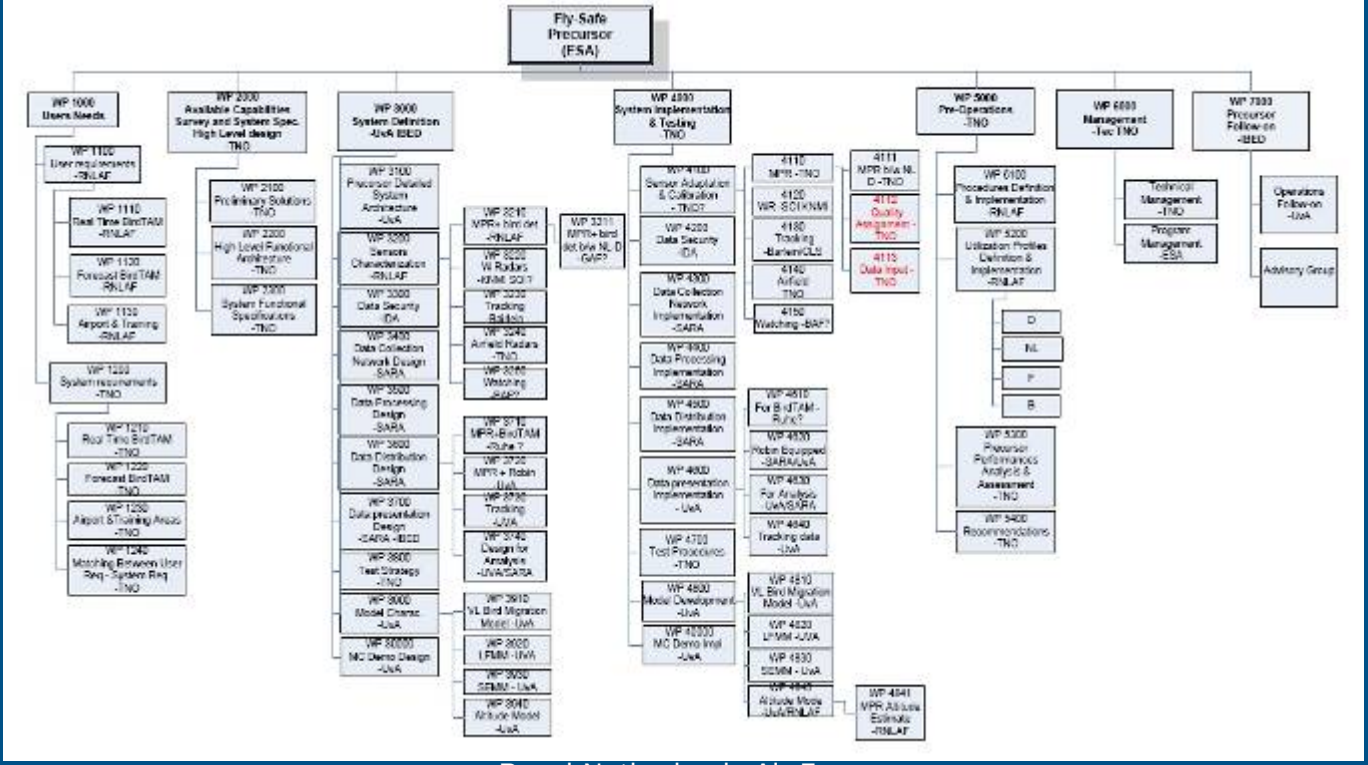
- Convincing by showing

- ESA as an honest broker -> trustworthy for all partners!

FlySafe project activities

Getting to know what is needed

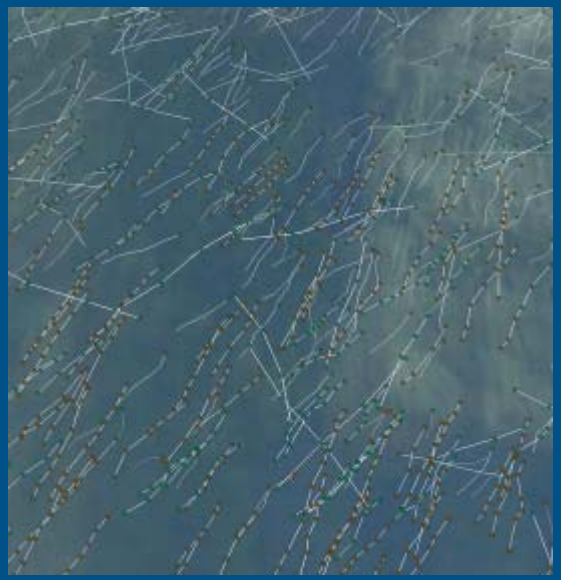
- User driven approach
- Define user requirements that are agreed by all parties
- Define project set-up

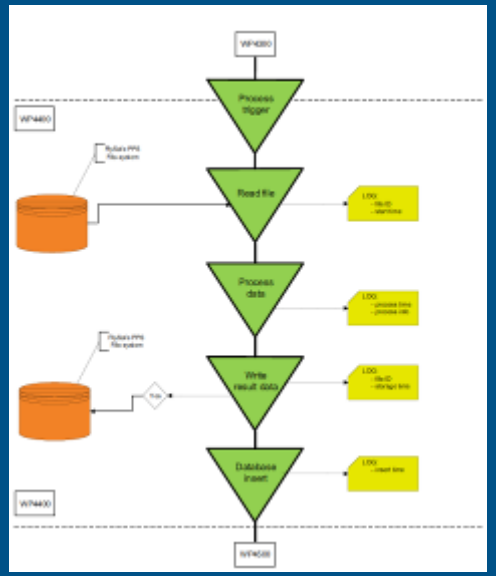


FlySafe project activities

Data management

- Central database for information from ALL sources
- Dissemination and storage of individual bird tracks from 2 MPR radars
- Website, including visualisation tools

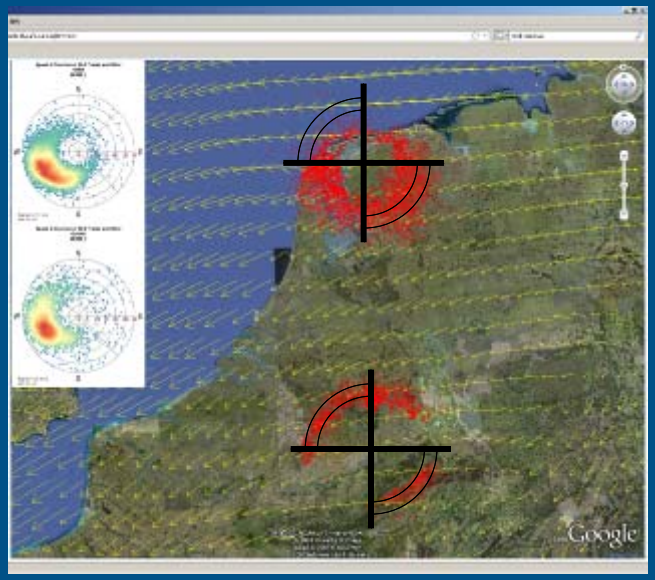


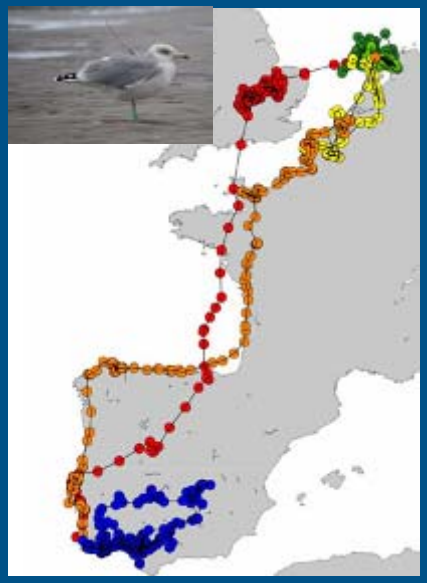


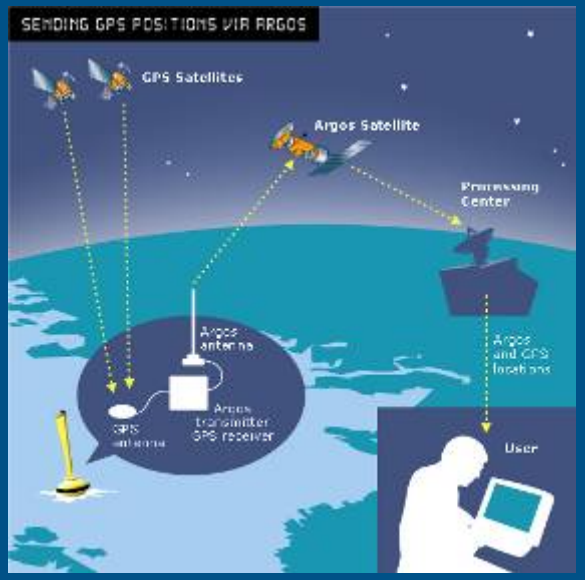
FlySafe project activities

Development of automatic 24/7 prediction models

- 4 locations (2 B + 2 NL)
- MPR radar history
- weather data
- earth observation
- GPS logging of individual birds



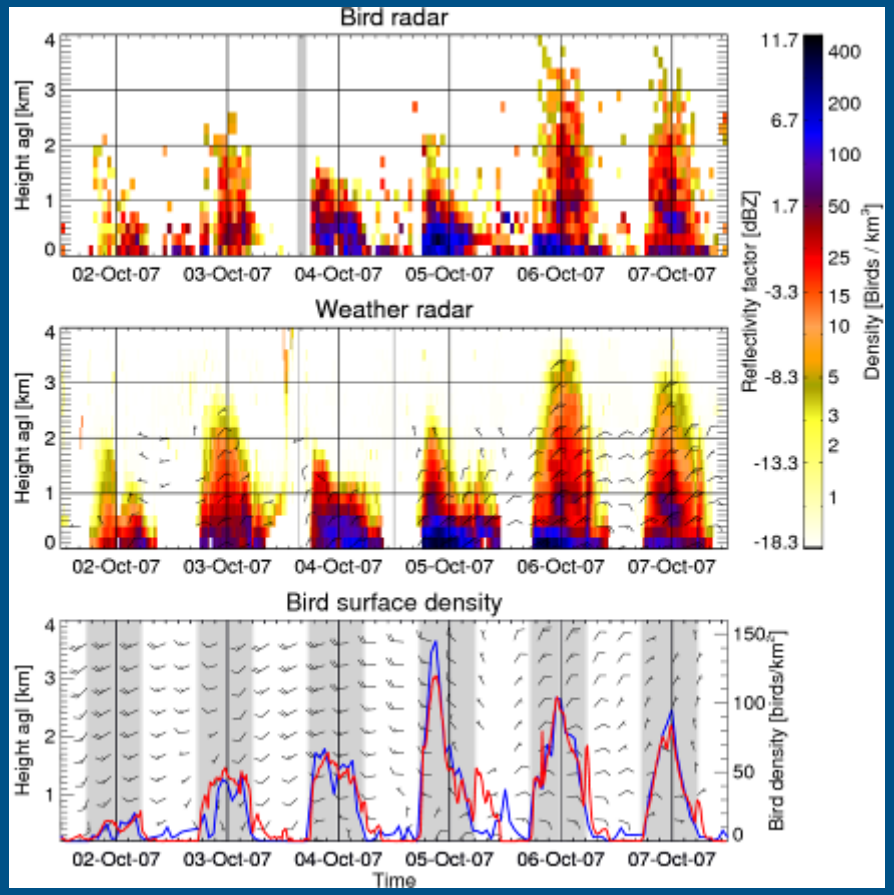




FlySafe project activities

Develop algorithms for weather radars

- 4 radars (2 B + 2 NL + 1 F)
- parallel observation series
- Swiss research radar

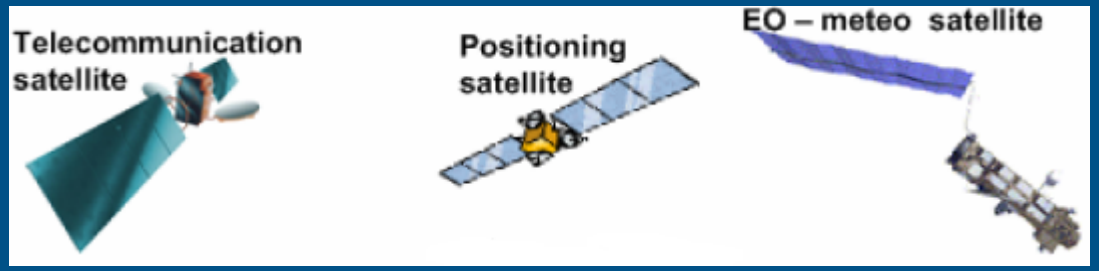


FlySafe project activities

Trial of on-airfield avian radar (ROBIN Lite)

- prevention of local bird strikes
- 2 D radar on 1 airbase

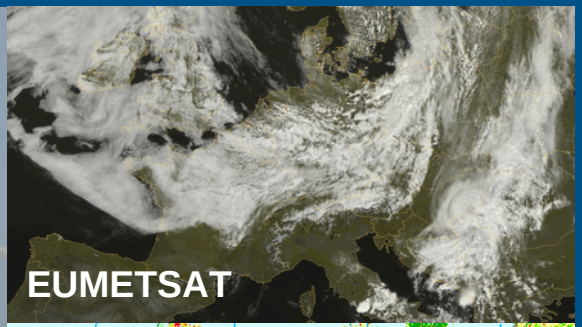
Role of space

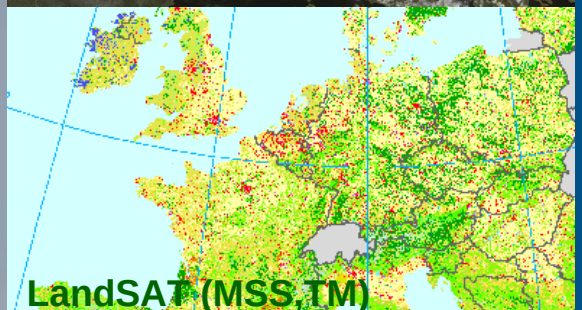


Satcom for Sensors Remote Locations

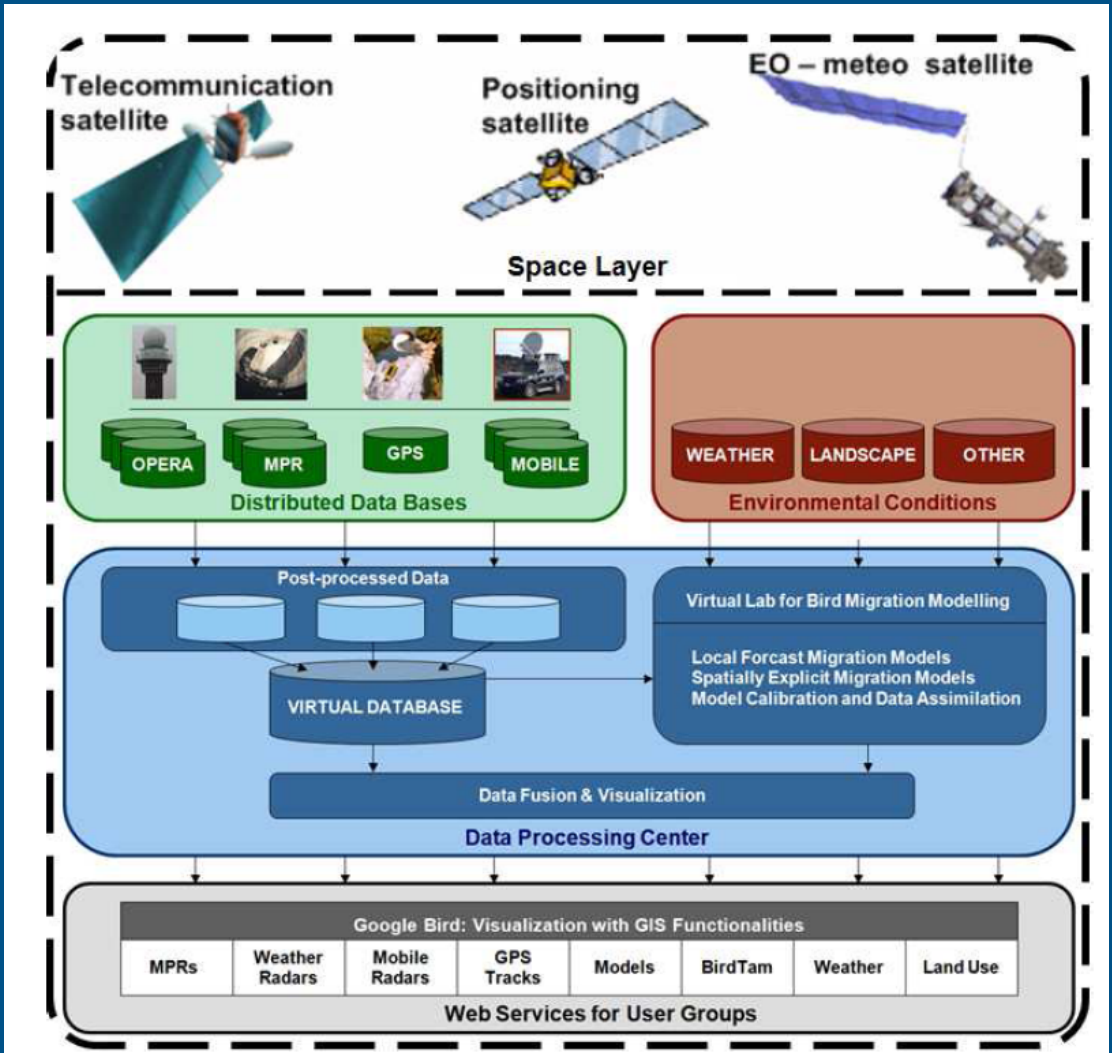
Birds with Backpack GPS-ARGOS

Weather & Land Cover





FlySafe System Set-up



FlySafe results

General:

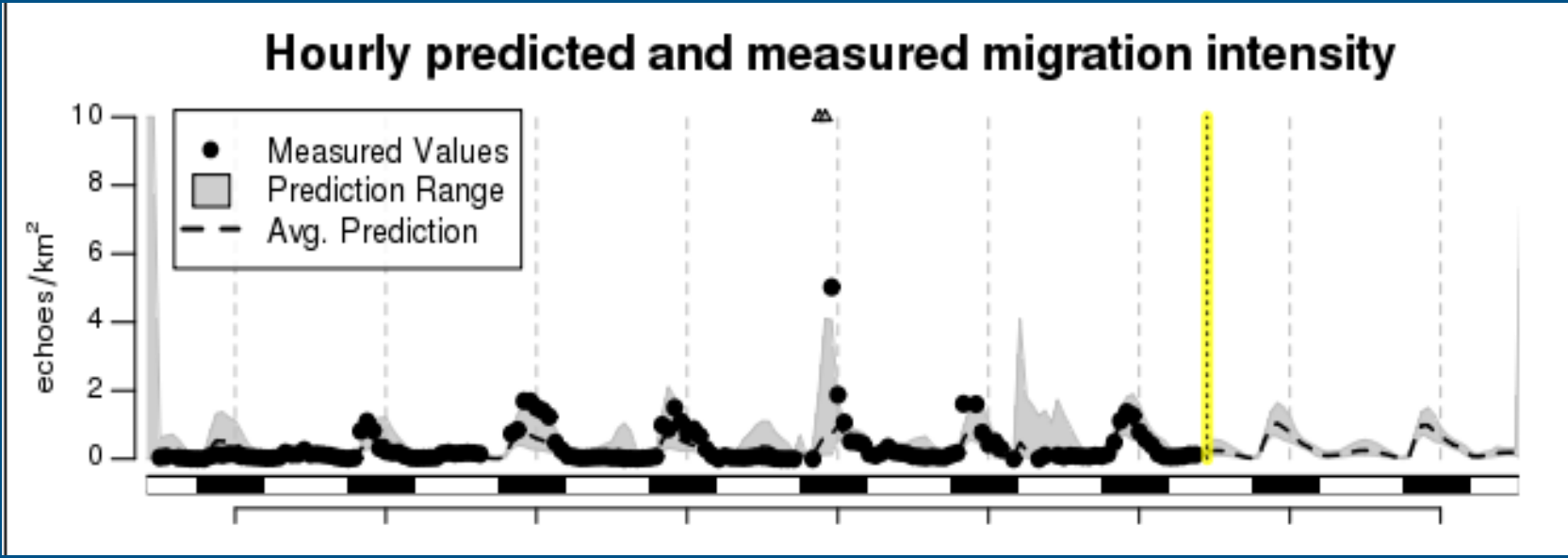
- Better co-ordination between D/B/NL
- Interdisciplinary co-operation that created added value

Services for BAF + RNLAF

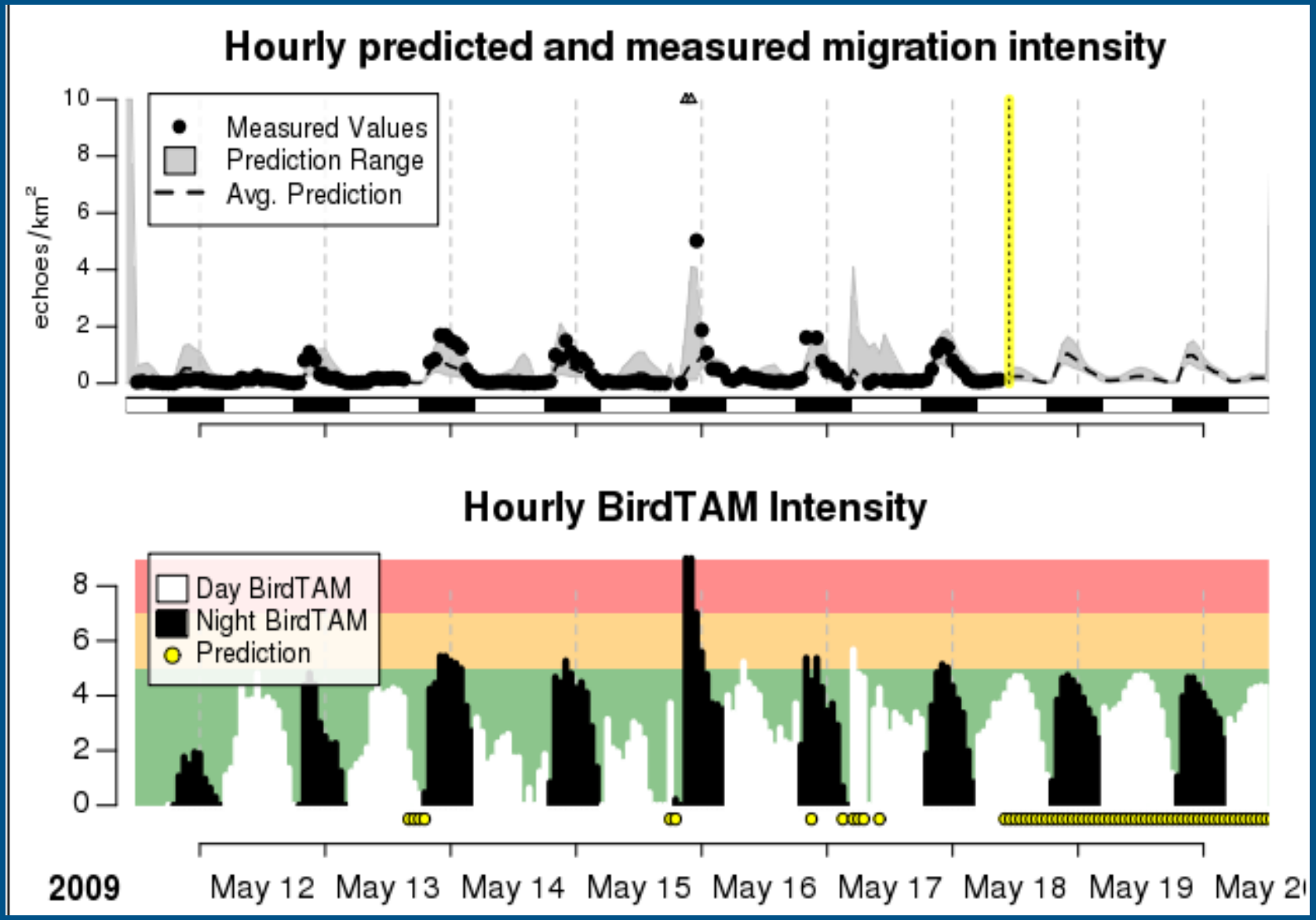
- *Bird mobility forecasts for 4 locations*
- *Automatic extraction of bird information from weather radars*

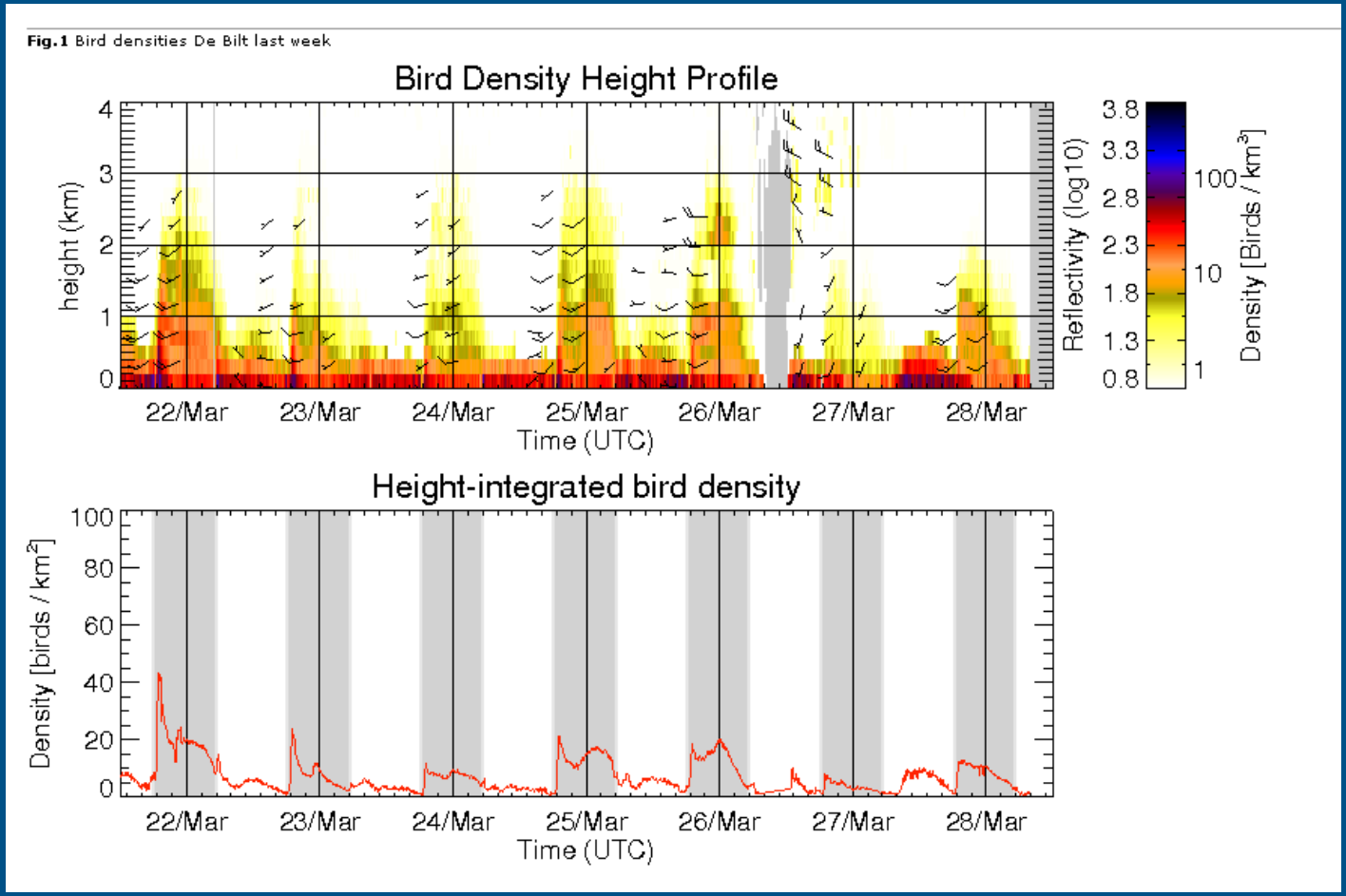
For on airfield situation:

- Potential of small bird radars as “last line of defence”



For 4 locations (2B+2NL)
Prediction (dotted line) +margin (shadow)
Measurements (black dots)
Missing radardata (triangles)
Translation to BIRDTAM values


Hourly predicted and measured migration intensity
Measured Values
Prediction Range
Avg. Prediction
echoes/km²
10
8
6
4
2
0
Hourly BirdTAM Intensity
Day BirdTAM
Night BirdTAM
Prediction
8
6
4
2
0
2009
May 12
May 13
May 14
May 15
May 16
May 17
May 18
May 19



2 NL weather radars
Density (colours)
Altitude (Y axis)

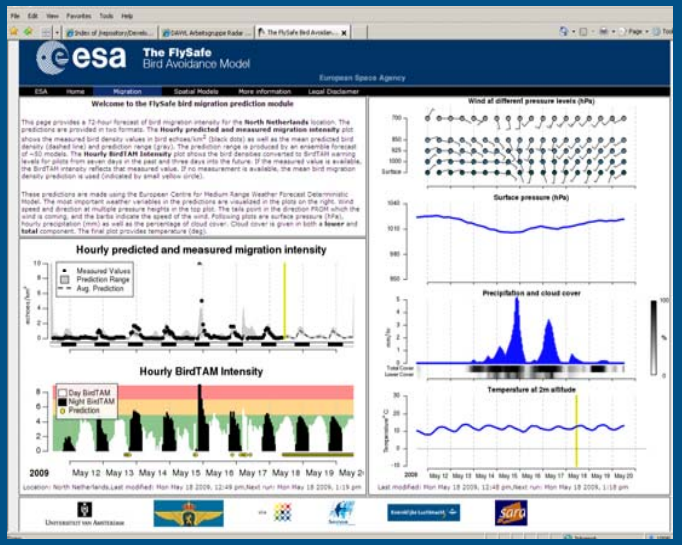
FlySafe results and project use by RNLAF

Creation of BIRDTAMS:

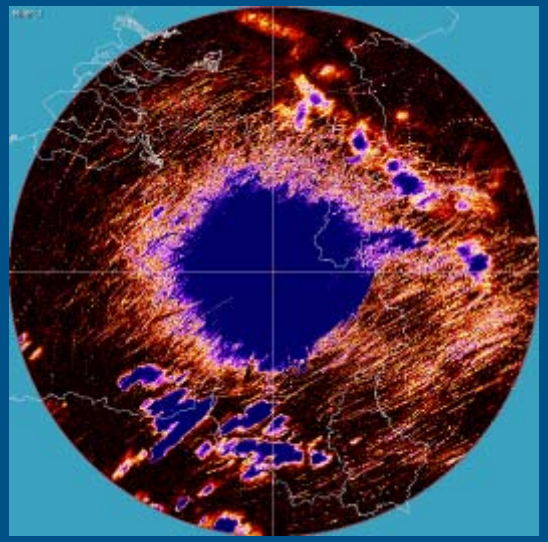
- More objective, more reliable
- Safer with less operational restraint

Daily use of:

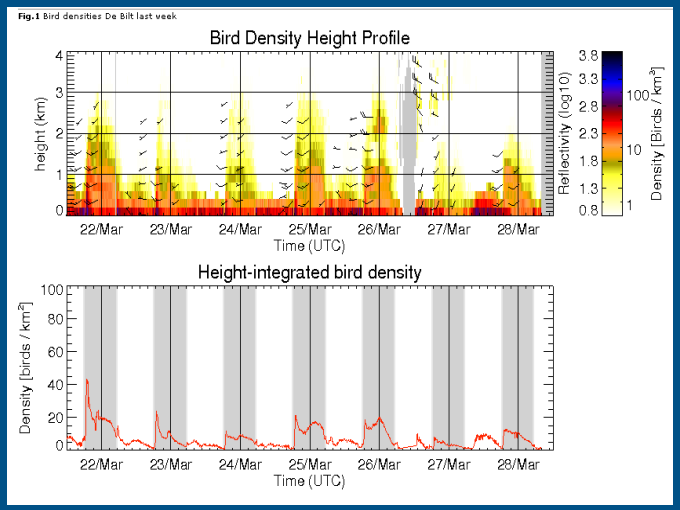
The models



The MPR radars



The weather radars



FlySafe follow-on (military aviation)

Pre-operational services hosted by KNMI (2011):

- Sustainable within existing cooperation between Air Force and KNMI
- 24/7 automatic running of models
  2 B + 2 NL locations
- 24/7 automatic extraction from weather radars
  3 B + 2 NL locations

FlySafe-2 (2011-2013):

- Building upon FlySafe-1, RNLAF funded
- additional time-based modelling using weather radar
- new modelling of altitude based on weather radar
- addition of >6 weather radars in neighbouring countries
- teaming up with EU *Lifewatch* program

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BELGIAN AIR FORCE

FlySafe project use and operational impact for Belgian Air Force flying activity

Serge Sorbi (BAF)

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Belgian Air Force

Birdstrike prevention “en route”

- **Giving information to pilots so that they can avoid high bird density zone.**

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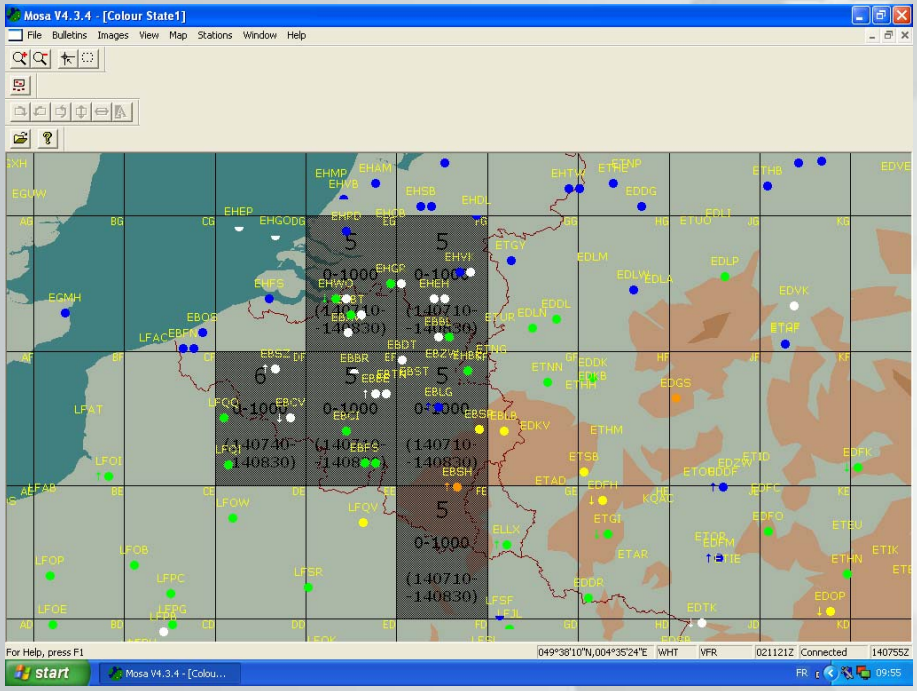
BIRDTAM

- **Information is transmitted by specific message : BIRDTAM**

- **BIRDTAM also broadcasted via the pilot's meteorological support software.**



- Georef square
- Bird Intensity
- Altitude
- Validity period

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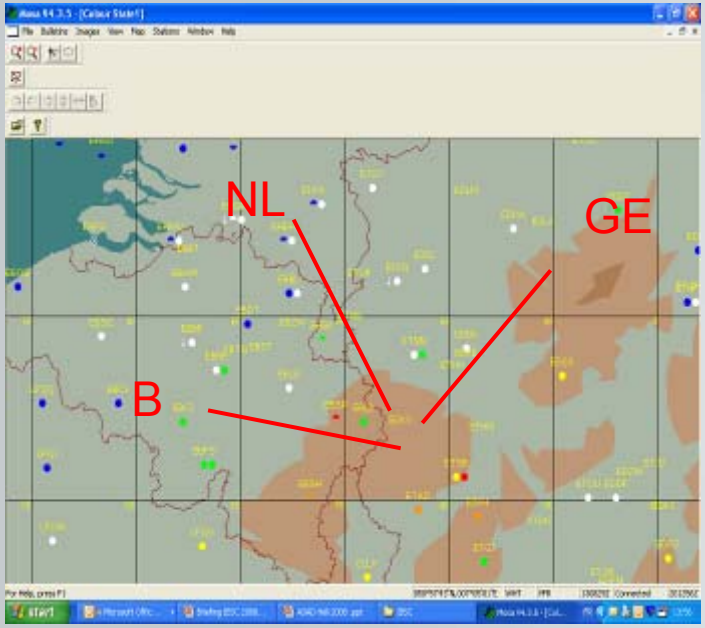
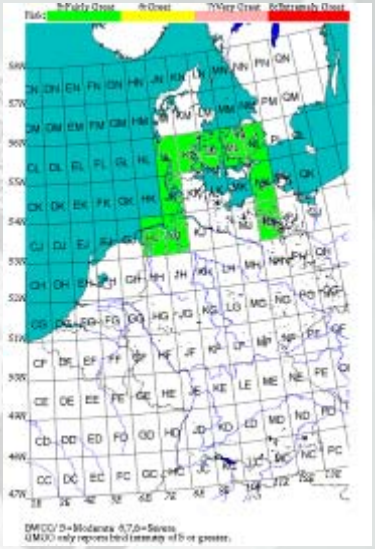
FlySafe project improvement

- **Necessity of harmonization of BIRDTAM broadcasted by different countries for a common georef square.**



International NOTAM
Database
Traben trarbach



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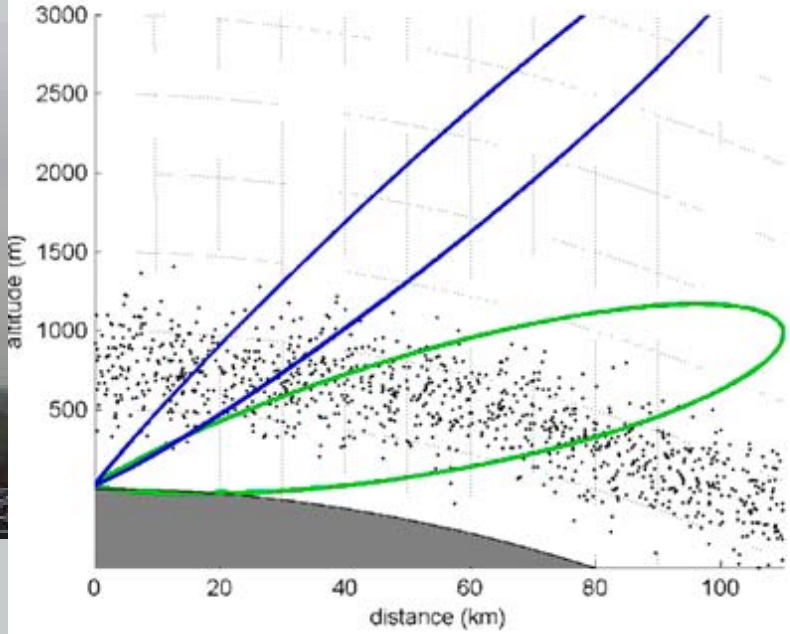
FlySafe project improvement

Better altitude information by use of meteo radar.



Simulated echo detection with MPR beams

1000 bird echoes
Max. detection distance: 110 km.
Selected distribution: "Normal".
Mean altitude: 800 +/- 200m.

Reflectivity factor [dBZ]

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BIRDTAM impact on flying operations

- Due to BIRDTAM, the flying operations can be limited (BIRDTAM ≥ 5) or even totally cancelled (BIRDTAM = 8).

- It has a direct operational impact on the flying program and can have a financial impact for BAF

- during bird migration period.
- during night flight period.

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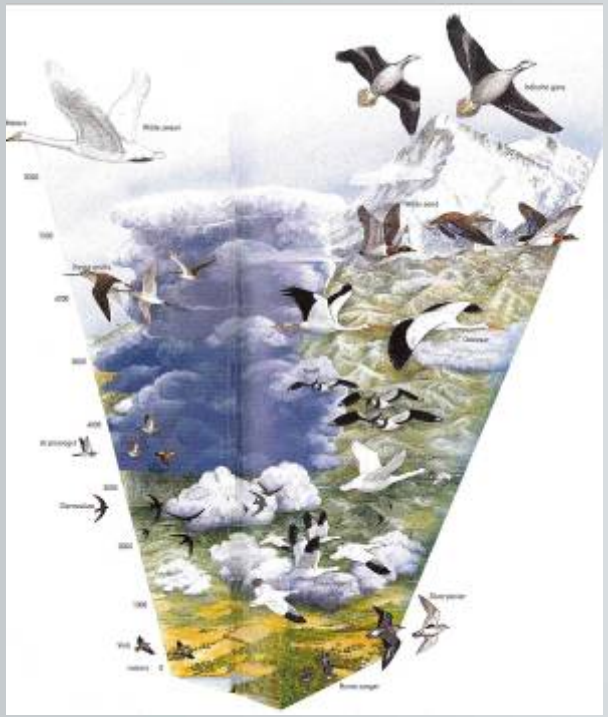
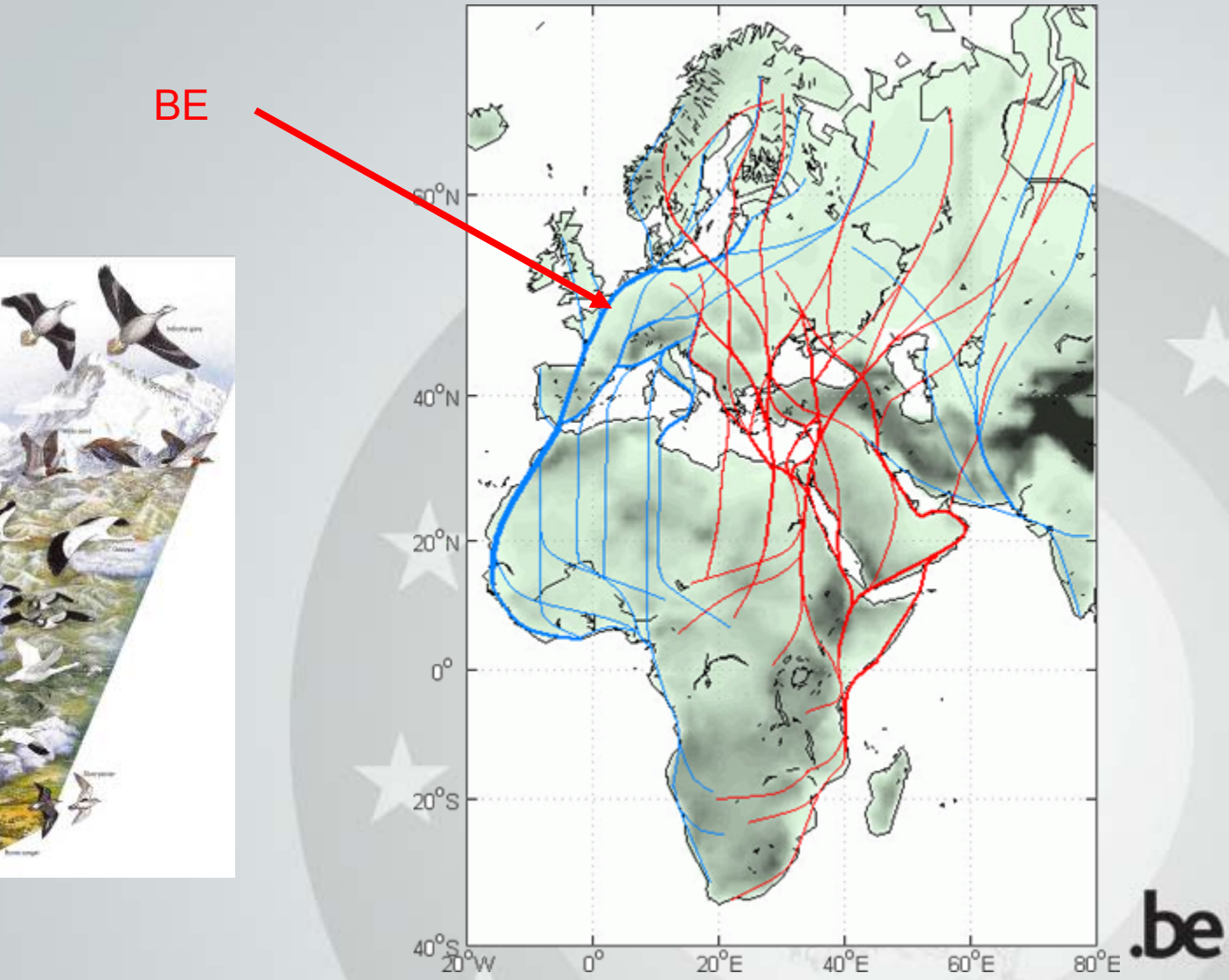
Bird migration above Belgium





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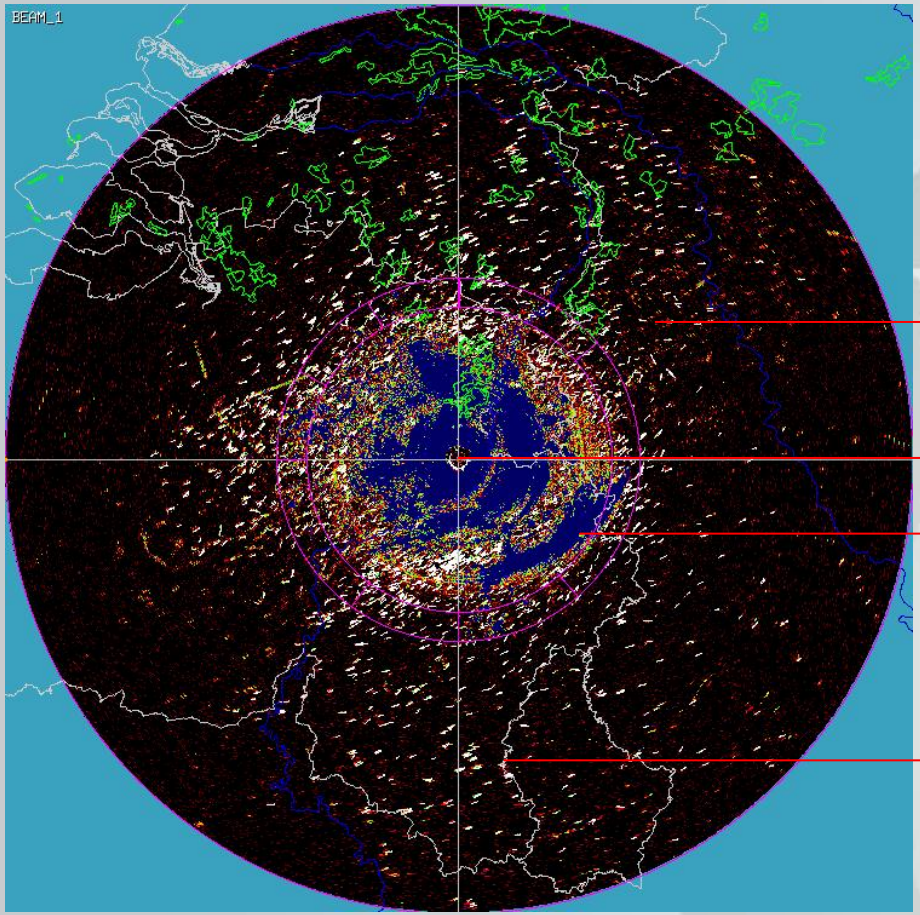
Bird migration above Belgium

MPR radar = Robin picture (100 sec)



Bird tracks

Radar location

Ground clutter

Belgian border

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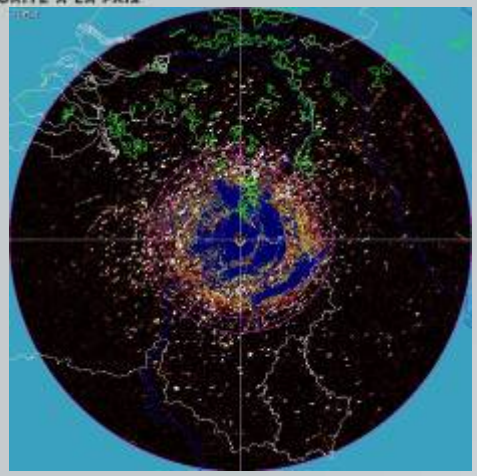
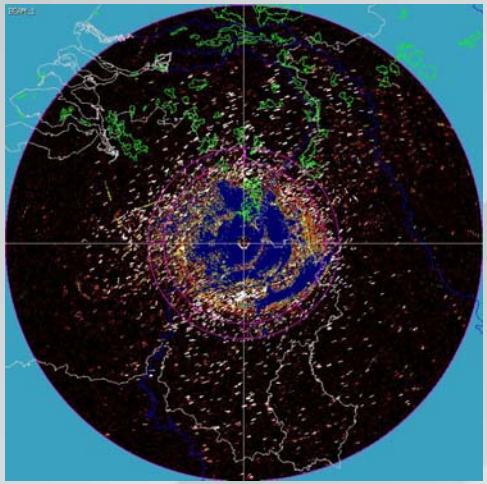
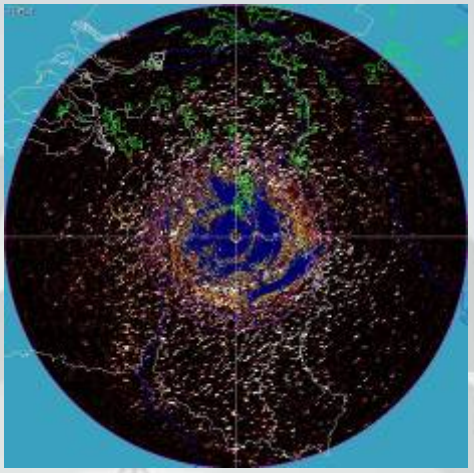
Bird migration above Belgium



08 march 2011 – 1625z



08 march 2011 – 1655z



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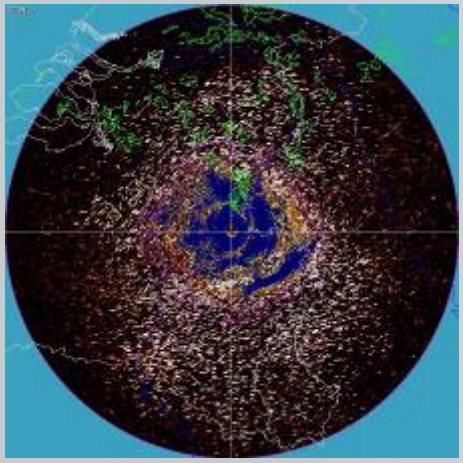
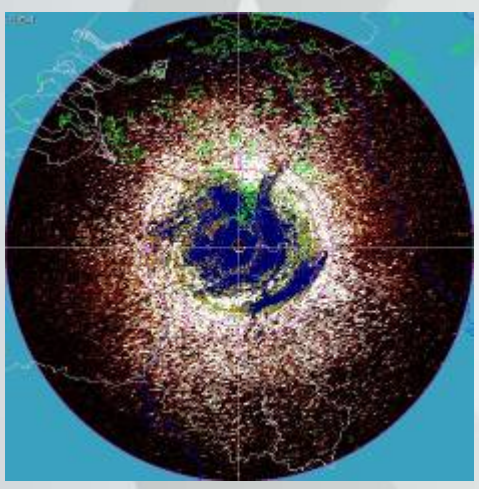
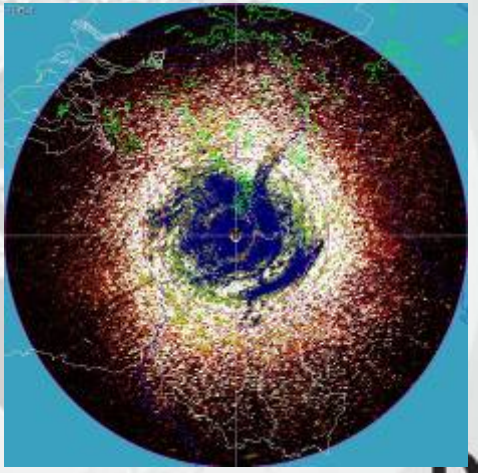


08 march 2011 – 1755z

DUSK



08 march 2011 – 1825z



08 march 2011 – 1855z

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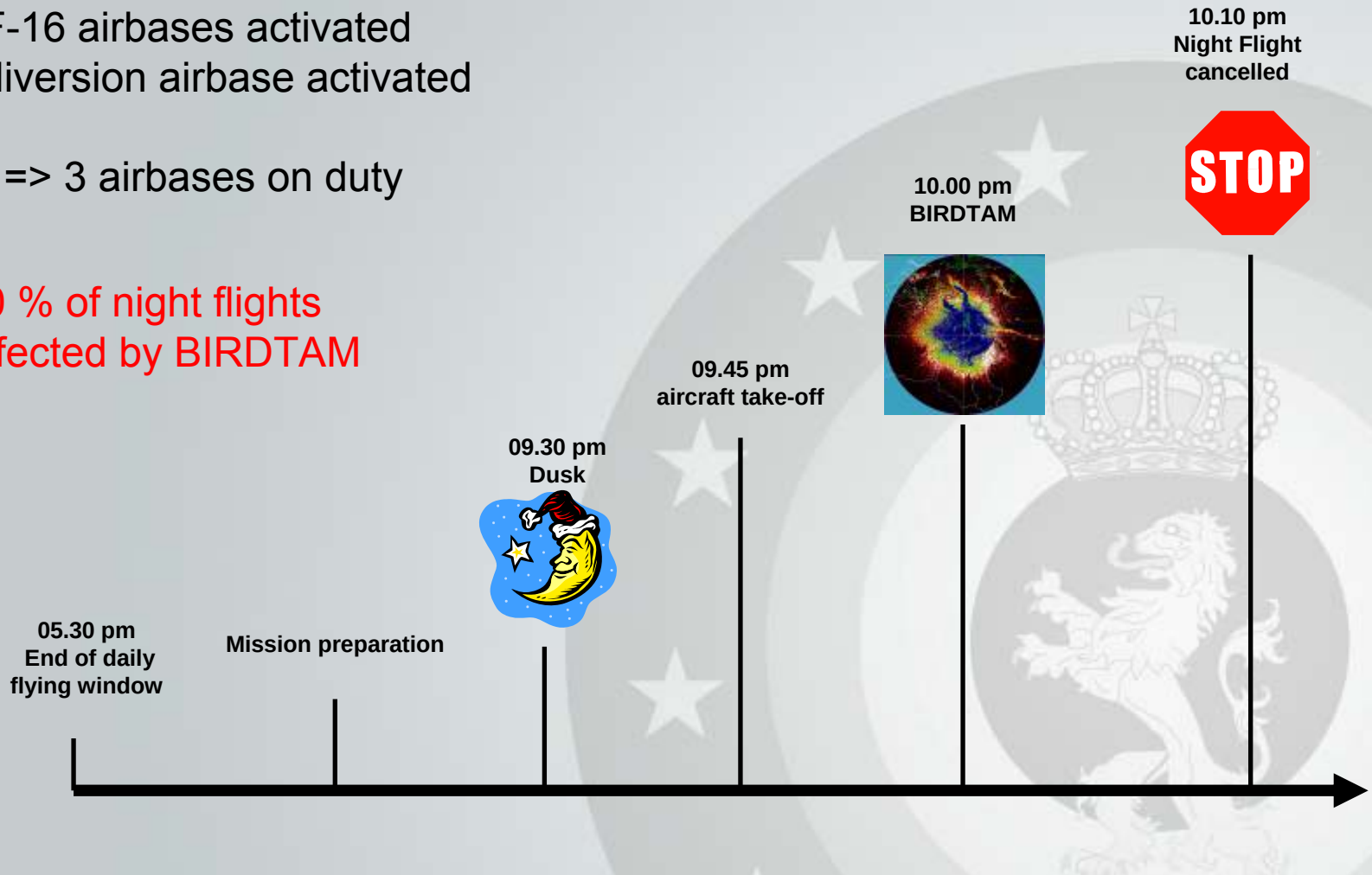
Impact of bird migration on F-16 night flight operation

2 F-16 airbases activated
1 diversion airbase activated

=> 3 airbases on duty

30 % of night flights affected by BIRDTAM



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Impact of lack of forecast in case of night flights cancellation.

Services on duty : Stand-by for nothing !

Flight planning disturbed, time & money lost

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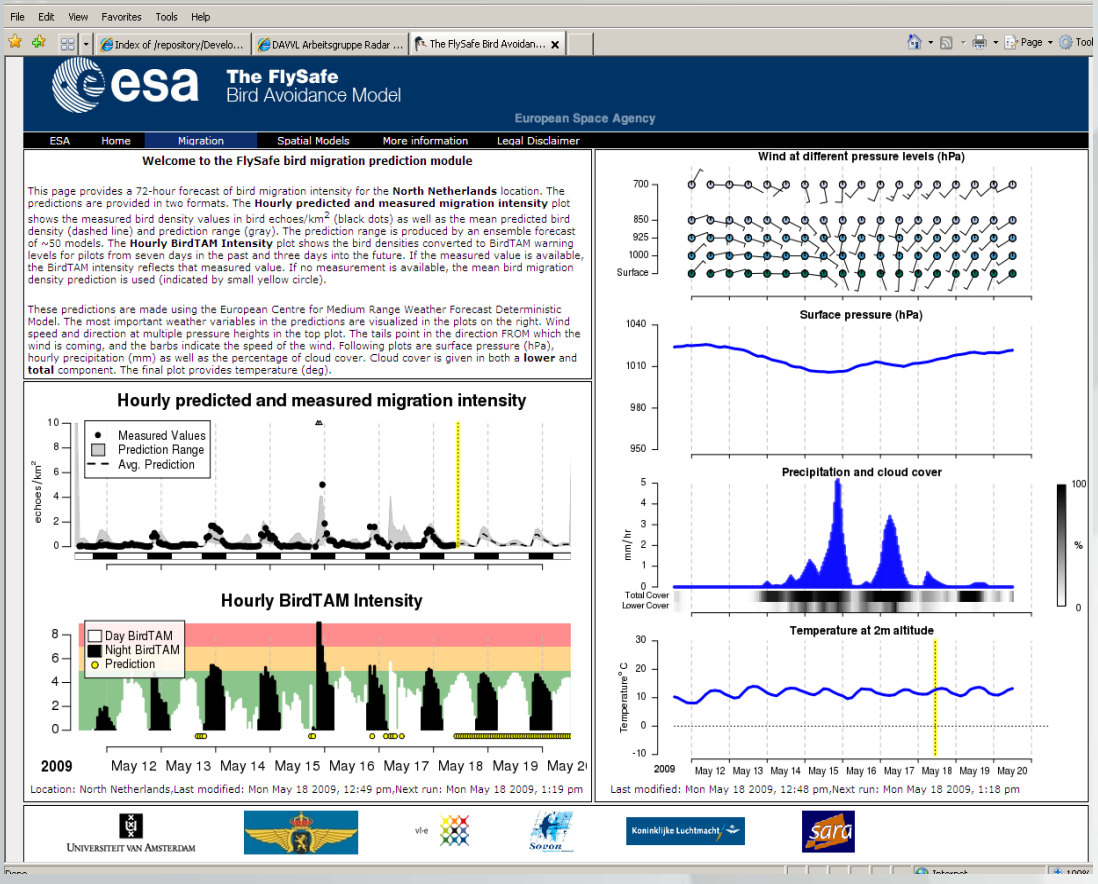
BIRDTAM forecast
« For AF's, a way to save money »



- **Better planning of flying activity.**
- **In case of BIRDTAM 8 forecast : cancellation of night flights**
- **48 hrs forward**

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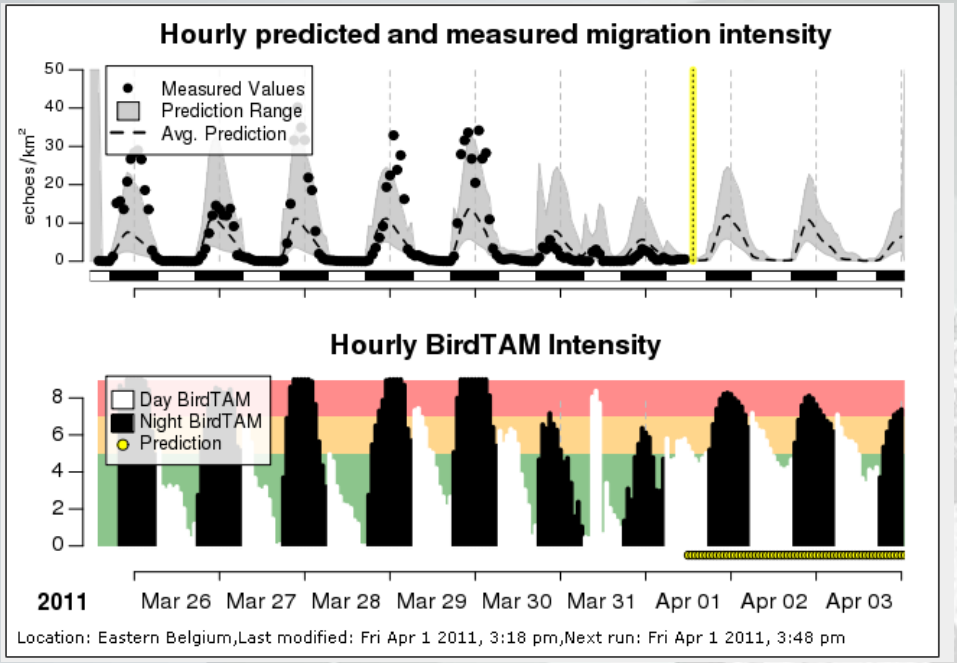
BIRDTAM forecast
« For AF's, a way to save money »

- **Belgian BIRDTAM forecast developed in the framework of the FlySafe Project**



- **Better flight planning, better time and human resources management => money saved**

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QUESTIONS ?

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