

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

The background features a blue sky with white clouds. Overlaid on this is a large, faint, light blue oval shape. Inside this oval, there are several thin, intersecting curved lines that resemble orbital paths or flight trajectories.

FLYSAFE

Presentation to WAKENET Workshop

7th February 2007
EUROCONTROL Headquarters, Bruxelles

The challenge of Air Transport Safety

- Air traffic will **triple** in the next **20** years
- Ambition of Vision 2020 is that increased traffic will **not** be accompanied by **increased** accidents, meaning ...

... the performance of safety-related systems and procedures must be **tripled** in the 20 years
- This improvement must be achieved with :
 - All weather operation
 - Operation at airports 24 hours per day
 - 99 % of flight departing within 15 min of schedule

The FLYSAFE initiative

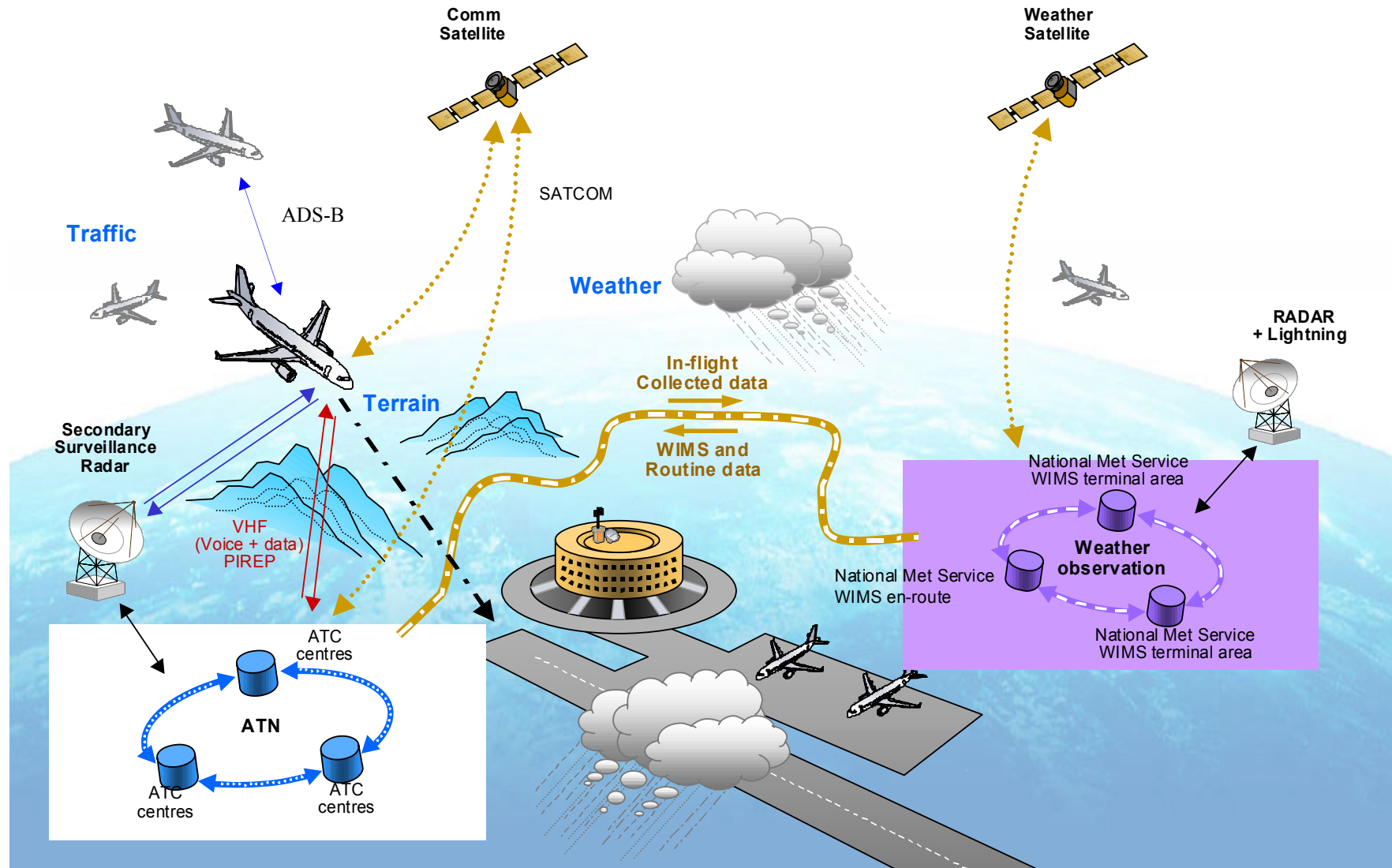
- Several EU programmes deal with the challenge of maintaining the high level of safety of Air Transport
- FLYSAFE contributes to meeting the ACARE agenda objective through :
 - the design, validation and testing of a **Next Generation on-board Integrated Surveillance System (NG-ISS)**, going a generation further than the existing integrated safety systems
 - the design, validation and testing of **ground Weather Information Management Systems (WIMs)**, gathering all relevant atmospheric information to inform the aircraft along their mission
- These systems are designed to deal with :
 - All flight phases
 - All weather situations
 - At minimum cost and weight

The FLYSAFE consortium



36 Partners from 14 different countries constitute a powerful consortium

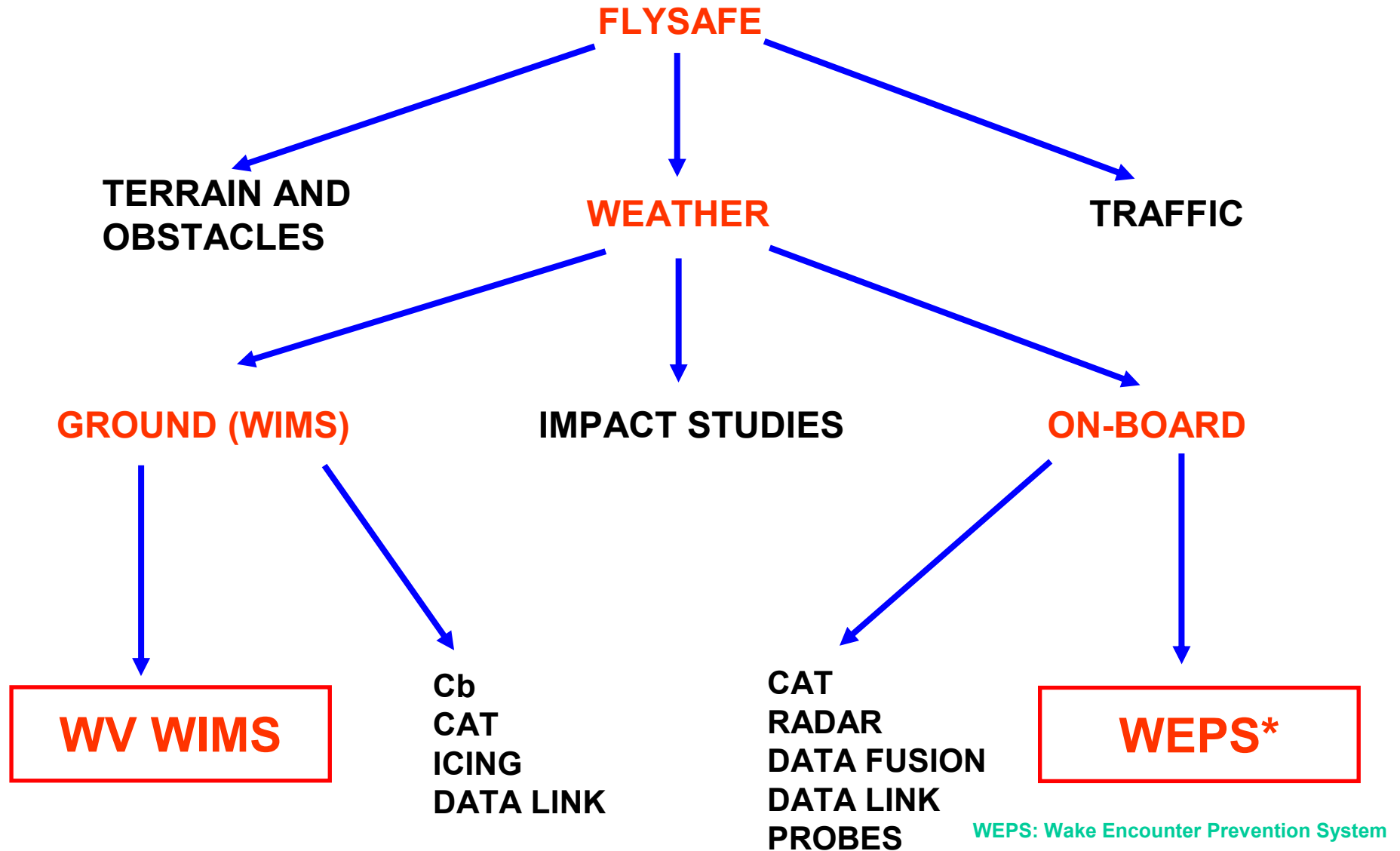
FLYSAFE overall concept



FLYSAFE WBS

“Driving factors”

- Review of past accidents, analysis and definition of means (that would allow) to prevent them with careful consideration of human factors issues
- Analysis in three branches for the different hazard information management
 - Weather, with specific studies in atmospheric hazards
 - Traffic
 - Terrain and obstacles
- Definition and validation of a next-generation integrated solution
- Support the design and development with standardisation and certification activities



■ Objectives and Scope

● Design and development of WIMS for En-route and TMA

◆ En-route mode:

- provision of atmospheric parameter for on-board WV prediction by a **global** Numerical Weather Prediction (NWP) model;

◆ TMA mode:

- provision of atmospheric parameter for a/c by a **local** NWP model,
- provision of weather, wake, and a/c separation parameters for ATC by a **local** NWP model.

■ Partners

- DLR
- UK MET

Further information on WIMS WV for TMA will be presented at 10:30:
„Wake-Vortex Prediction and Monitoring System - Design and Performance at Frankfurt Airport“

■ Background

- Wake vortex separations are one limiting factor to air transport growth

■ Future requirements w.r.t. wake vortex:

- Dedicated & accepted methods to assure sufficient safety from wake hazards

■ Complementary mitigation strategies

- Benign vortex aerodynamic design
- Improved ATM concepts (e.g. time-based separation, re-categorisation)
- Ground-based wake prediction & monitoring systems
- **On-board wake detection, prediction & alert systems**
- On-board wake encounter alleviation systems



■ Main objective within FLYSAFE

- Demonstrate the functionality and applicability of an airborne Wake Encounter Prevention System (WEPS) as part of the Next-Generation Integrated Surveillance System

■ Sub-level objectives

- Specify target system (WEPS)
- Specify, develop and evaluate relevant sub-systems
(*prediction only*) on AIRBUS research flight simulator

■ Partners

- | | |
|------------|----------|
| ● AIRBUS | ● THALES |
| ● DASSAULT | ● TsAGI |
| ● DLR | ● UCL |



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- **Prevent severe wake encounters during all phases of flight**
- **Create additional tactical safety layer**
 - E.g. involuntary loss of safe separation
 - VFR operations
- **Alert crew with time for educated decision making**
- **Provide crew with instructions for safe avoidance**
- **Provide crew with improved situational information (facultative)**

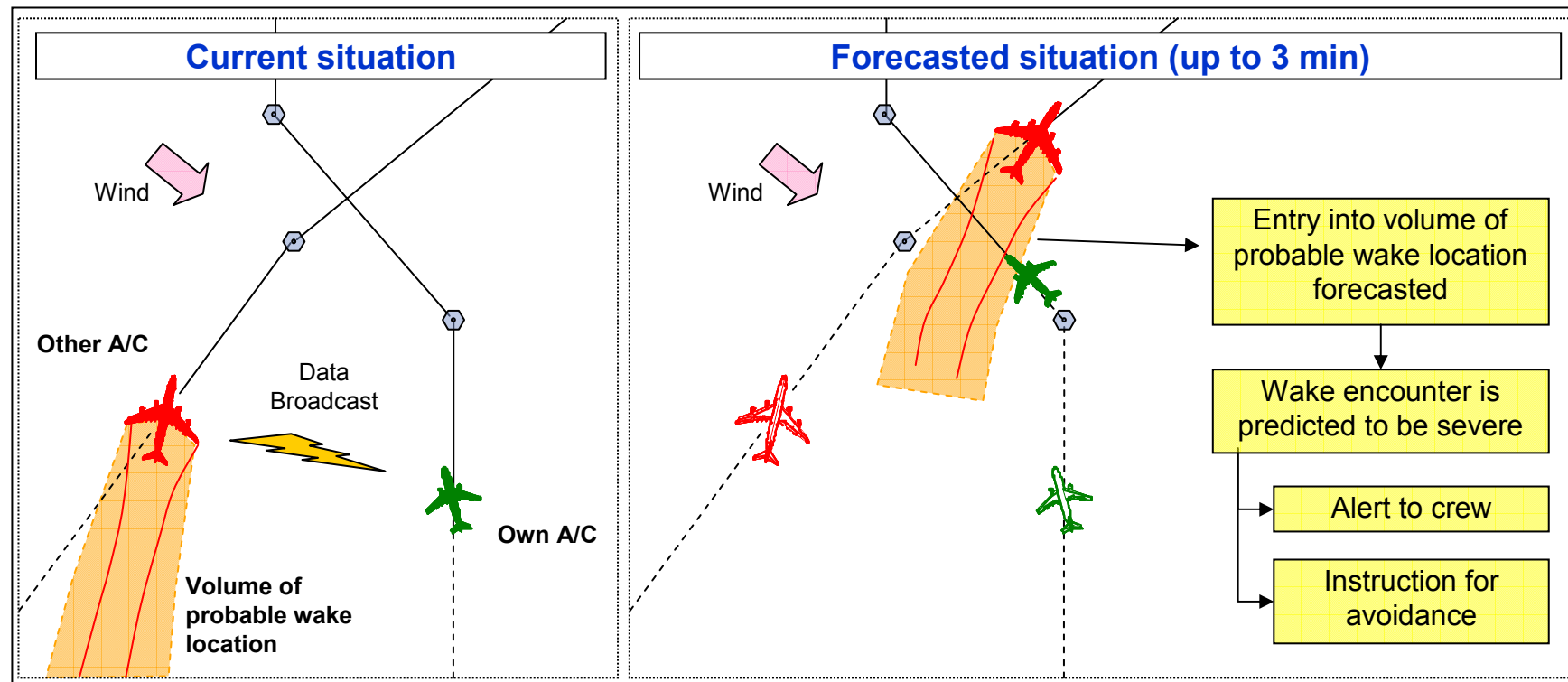
- **On-board sensor for wake detection**
 - **LiDAR or RADAR technology**
(not under detailed investigation within FLYSAFE)

- **On-board prediction of wake location and characteristics**
 - **Data input from own A/C, other A/C (cross-linked, e.g. ADS-B) and ground-based WIMS**
 - ◆ Meteorological data (e.g. wind, temperature, EDR)
 - ◆ Traffic data (e.g. A/C weight, speed, position, intent)

 - **Models to predict 3D wake evolution up to cruise altitude**
 - ◆ Probabilistic models to account for uncertainties
 - ◆ P-VFS by UCL and P2P by DLR

 - **4D conflict detection (i.e. forecasts of impending conflicts)**

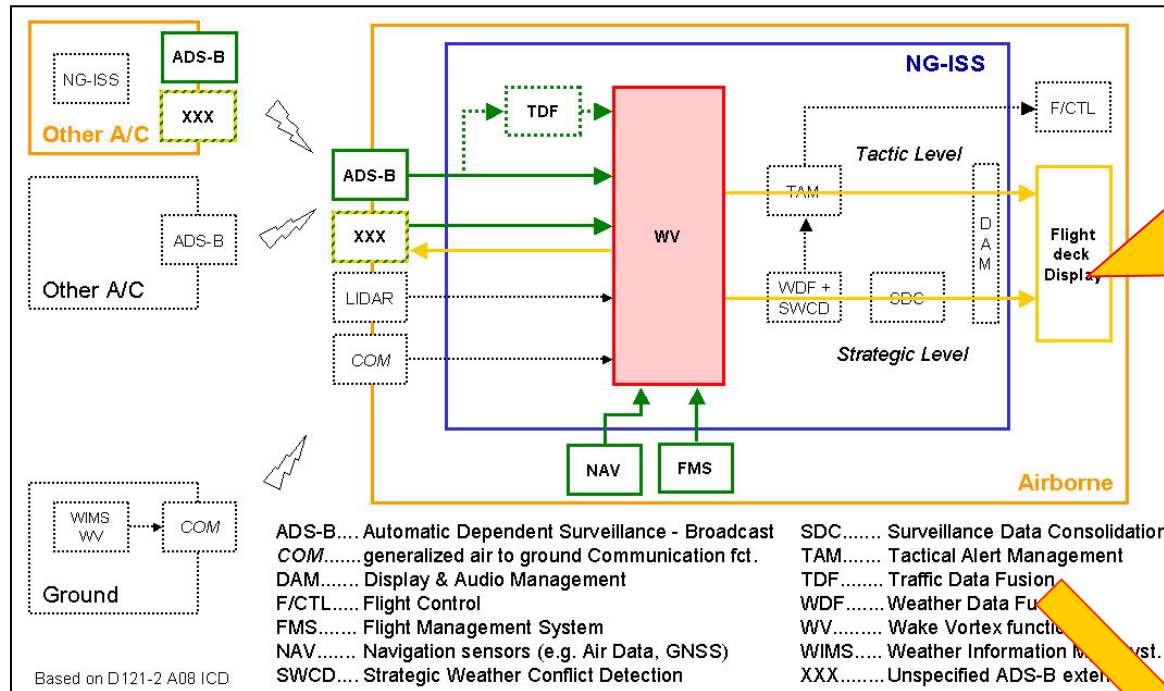
- Prediction allows to forecast impending encounters based on broadcasted traffic intent data (ADS-B)



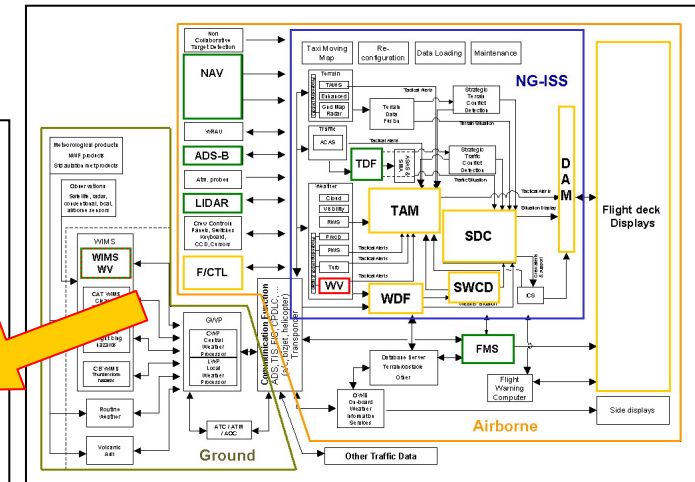
■ Key technologies for on-board wake prediction & alert

- Input data consolidation & fusion
- Probabilistic wake prediction models for all phases of flights
- Wake encounter severity assessment and estimation
- 4D conflict detection
- Operational aspects & HMI
- Safety assessment & system benefit analysis

■ Software development

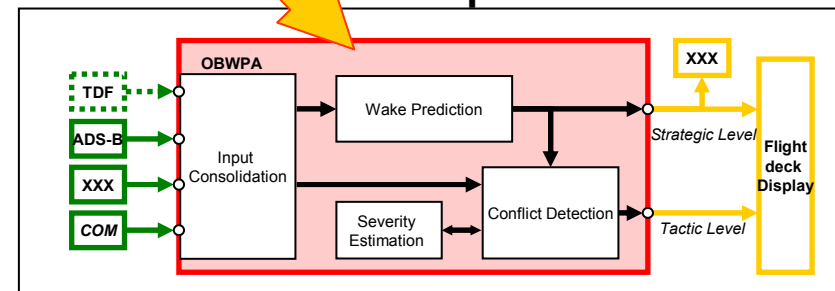


WEPS components



FLYSAFE overall system architecture

Software for part task evaluation



■ Status

- Specification of Wake Encounter Prevention System achieved
- Software for part task evaluation under development
- Flight simulator integration and piloted tests planned for 2007

■ Conclusions

- NG-ISS including WEPS may provide an additional safety layer with respect to wake vortex
- Several challenging technologies
- Part task evaluation under preparation



THALES



■ Thank you for your attention !