RUSSIAN WAKE VORTEX FLIGHT SAFETY SYSTEM: TODAY AND TOMORROW

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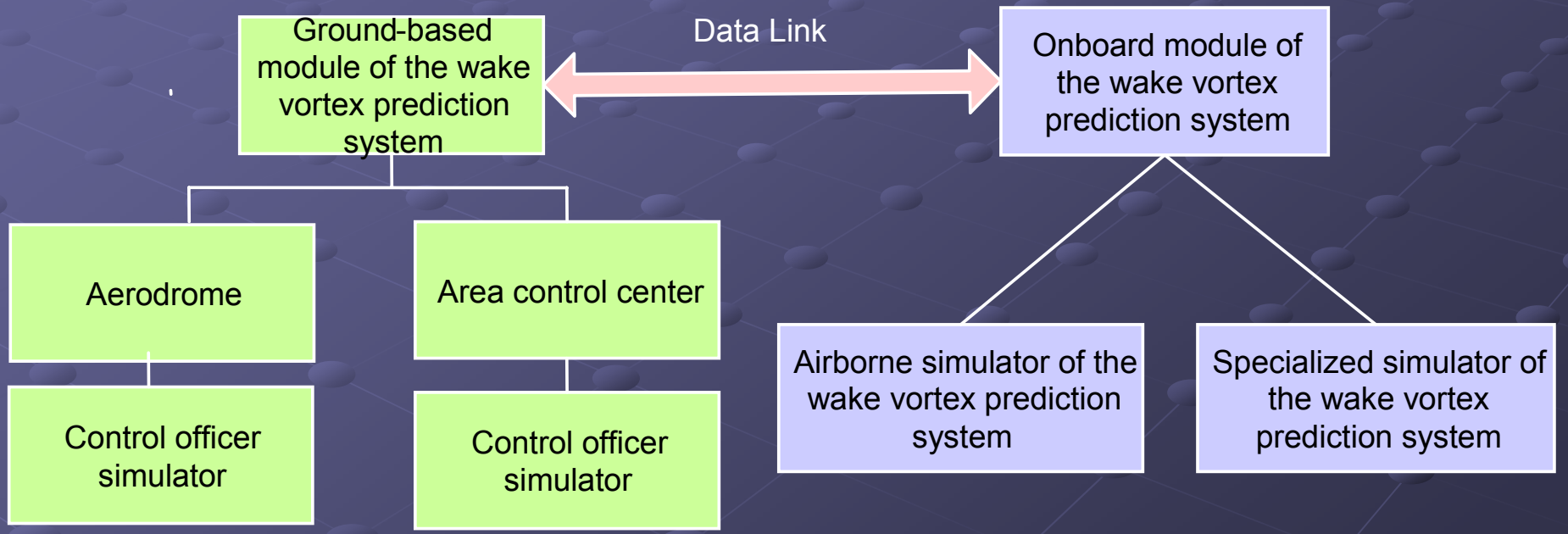
Integrated Wake Vortex Flight Safety System

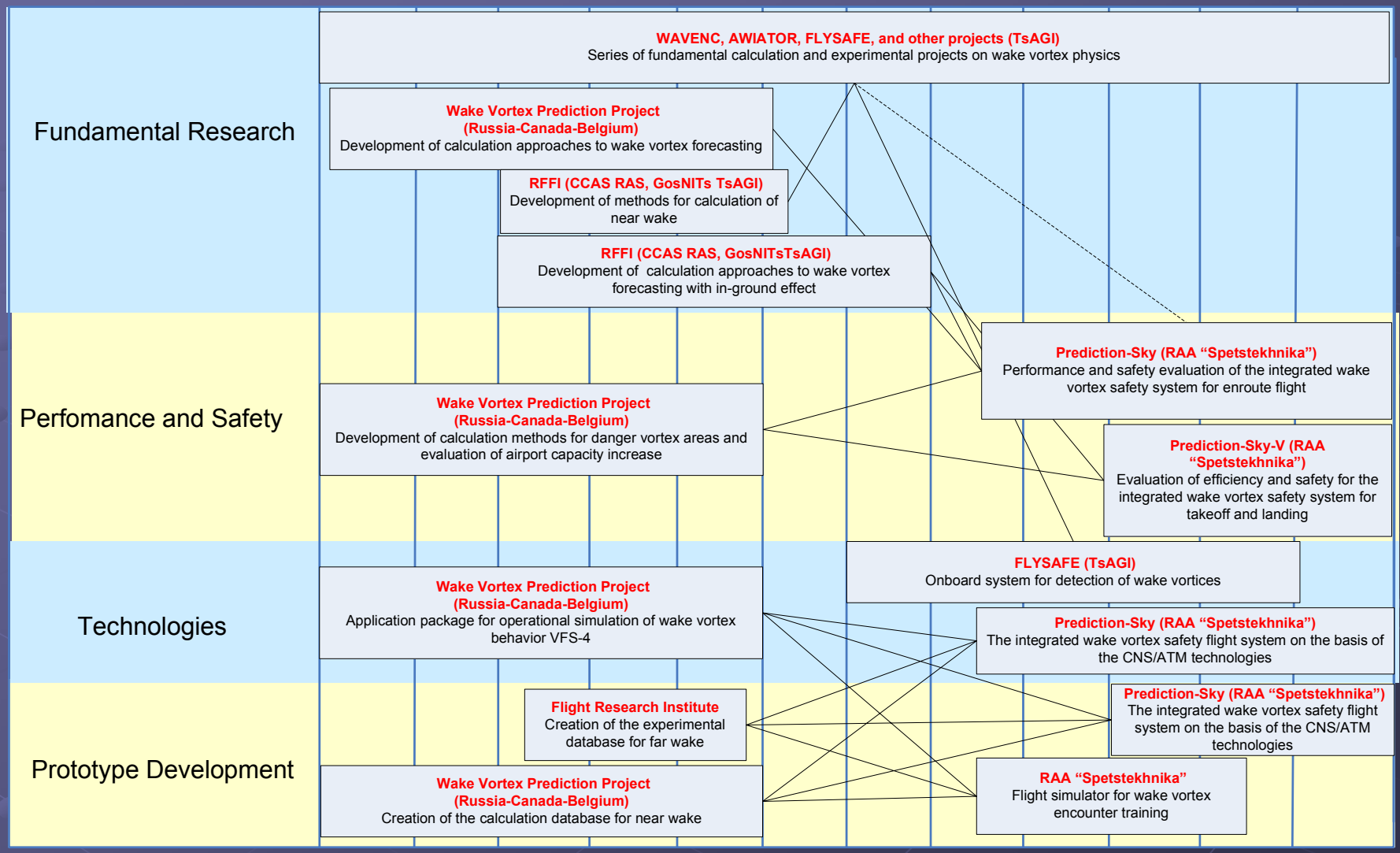
AIR TRAFFIC SERVICES PLANNING MANUAL
ICAO Doc 9426, Part II, Chapter 3, Appendix A
Item 1.2. User interests and needs for wake vortex avoidance are diverse. In general, the users can be divided into three main groups:
а) aerodromes;
б) aircraft; and
в) ATS.



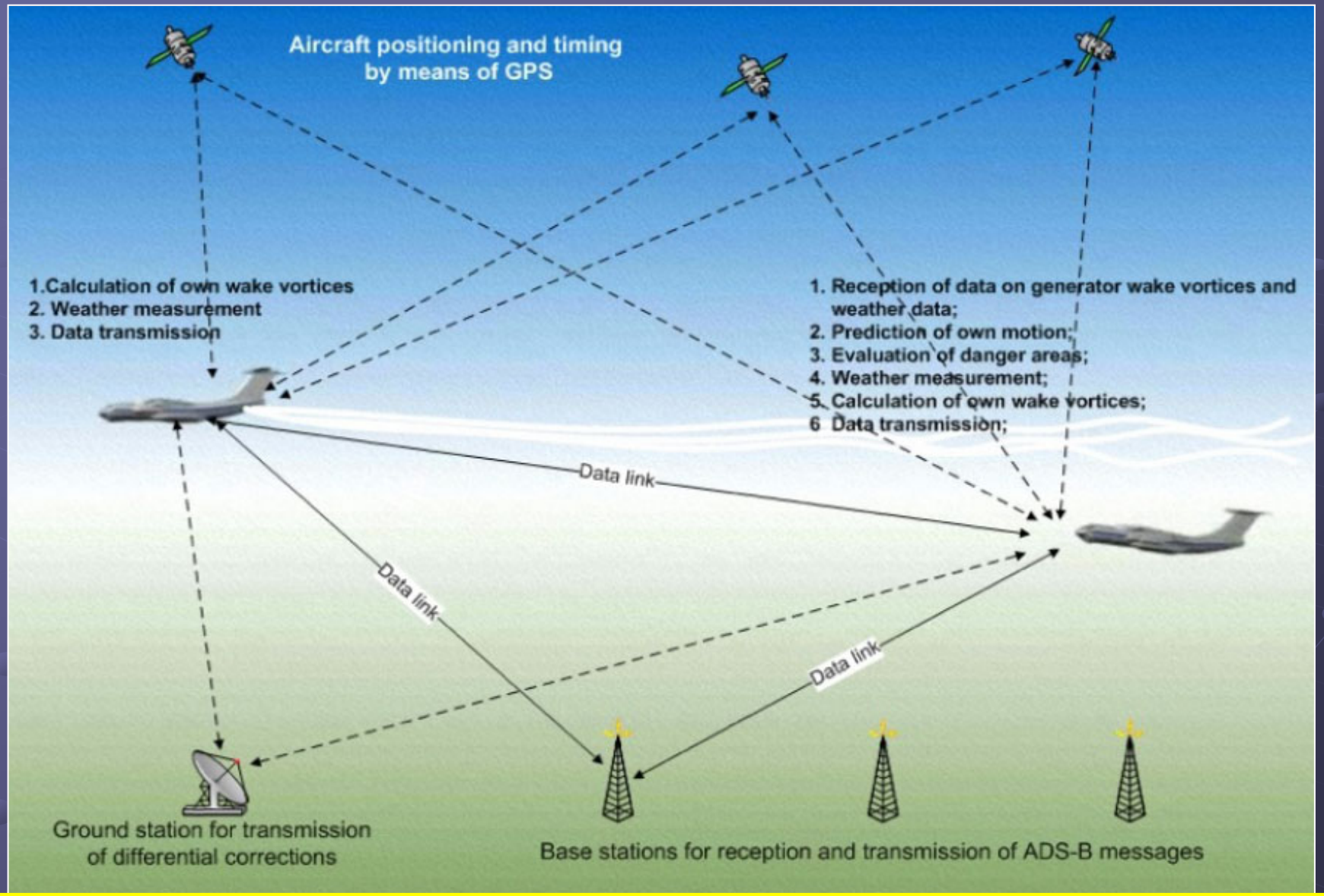
National Programmes for Wake Vortex Flight Safety

WakeNet - Europe	WakeNet - Russia	WakeNet – USA (FAA-NASA)
Integrated ATC Wake Vortex Safety and Capacity System ATC-Wake	Integrated System for Wake Vortex Flight Safety «Prediction-Sky»	Wake Vortex Advisory System Wake VAS

Russian Wake Vortex Projects



INTEGRATED WAKE VORTEX SAFETY SYSTEM



Main Performance Requirements for the Ground-Based Module of the Wake Vortex Subsystem

- Number of A/C involved: up to 300
- Responsibility area for the Ground-Based Module:

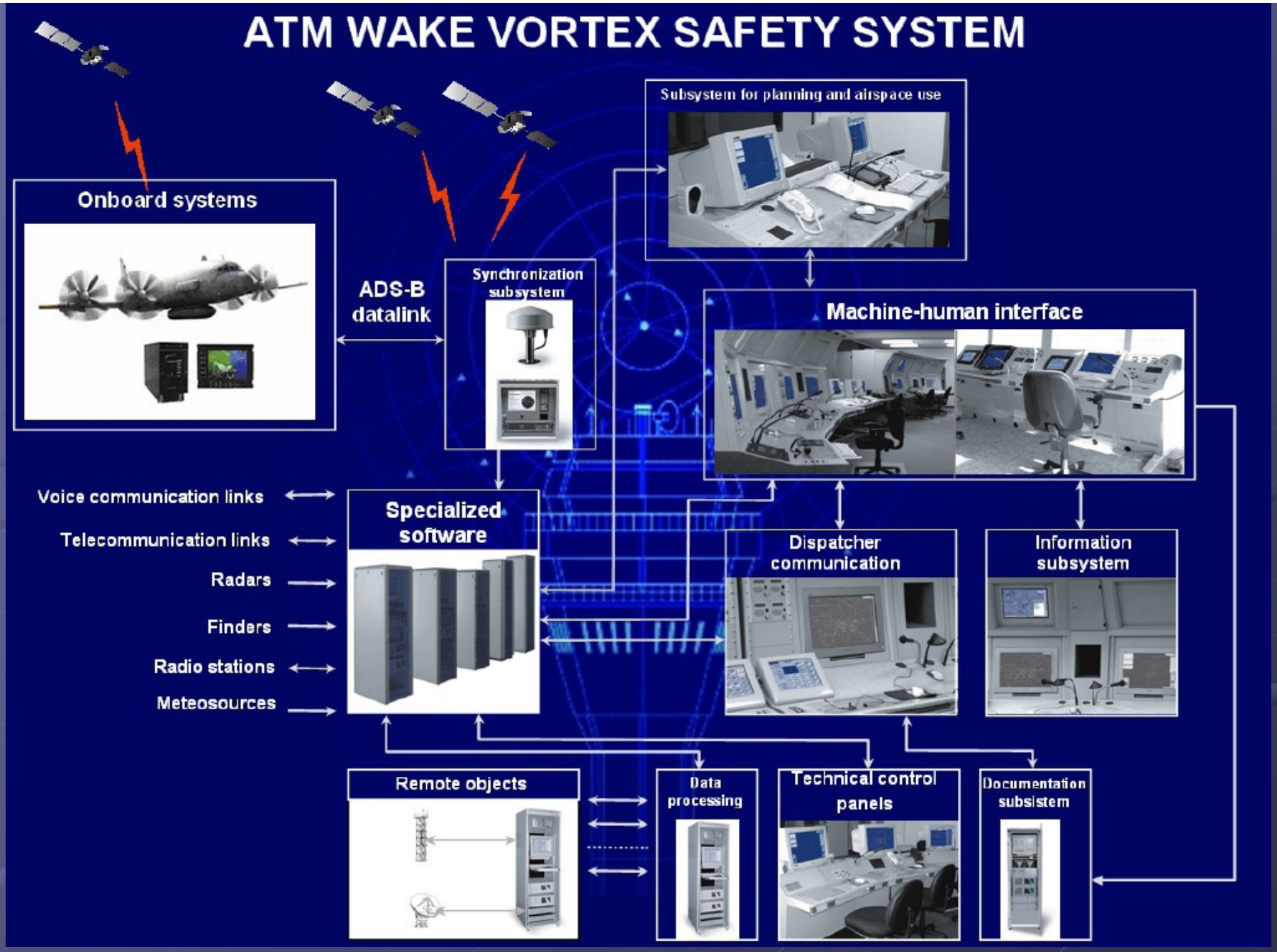
  - Height: 200…20,000 m

  - Area: 400 x 400 km (area control center); 1,500 x 1,500 km (enlarged area control center)
- Assurance level (mean time between failures): 6,000 hours
- Availability: 0.9998
- Useful operating life: not less than 10 years or 100,000 hours

Main Engineering Solutions Made at the Stage of Advance Planning

- The structure of the Ground-Based Module for the Wake Vortex Subsystem is determined
- Algorithms for the Ground-Based Module are developed
- The Ground-Based Module prototype for the area control center is designed
- Systematic studies in support of the main concepts are performed
- Computer simulations for estimation of the module operational capability and reliability are fulfilled

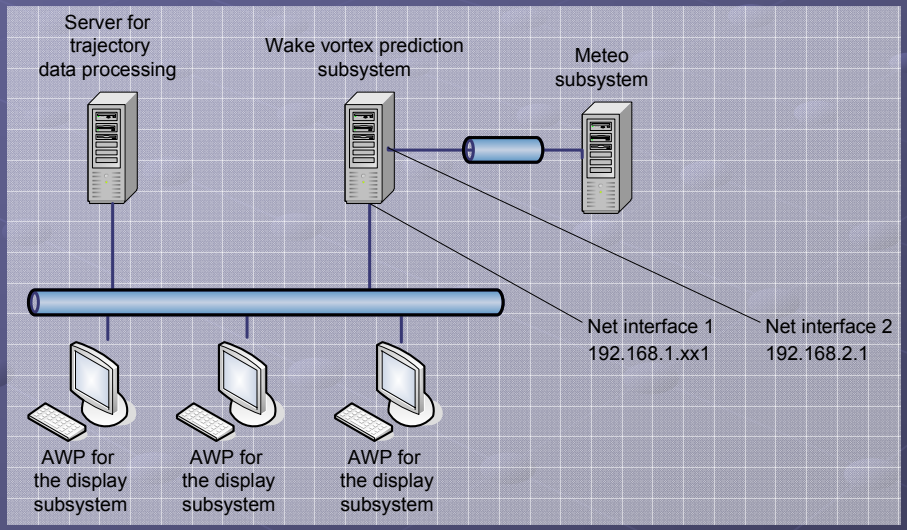
ATM WAKE VORTEX SAFETY SYSTEM



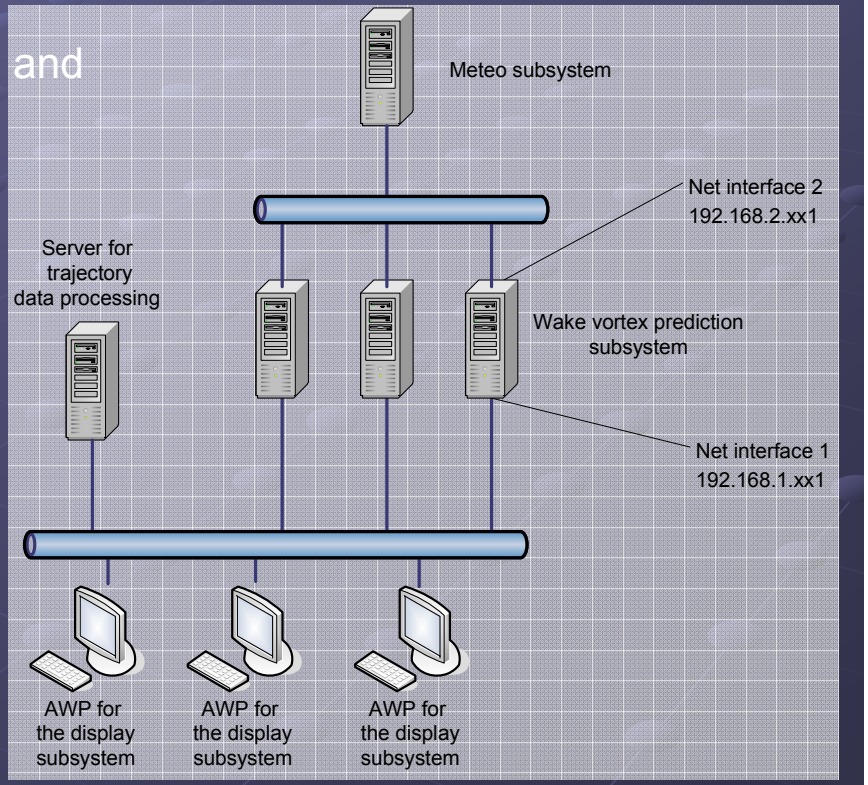
Circuit Design for the Hardware-Software Complex of the Ground-Based Module

The ground-based module implements data exchange among:
- the server of the general complex ‘Surveillance Systems…’ (trajectory data processing)
- the automated working places (AWP) (traffic display), and
- the meteo server,

and contains two net interfaces

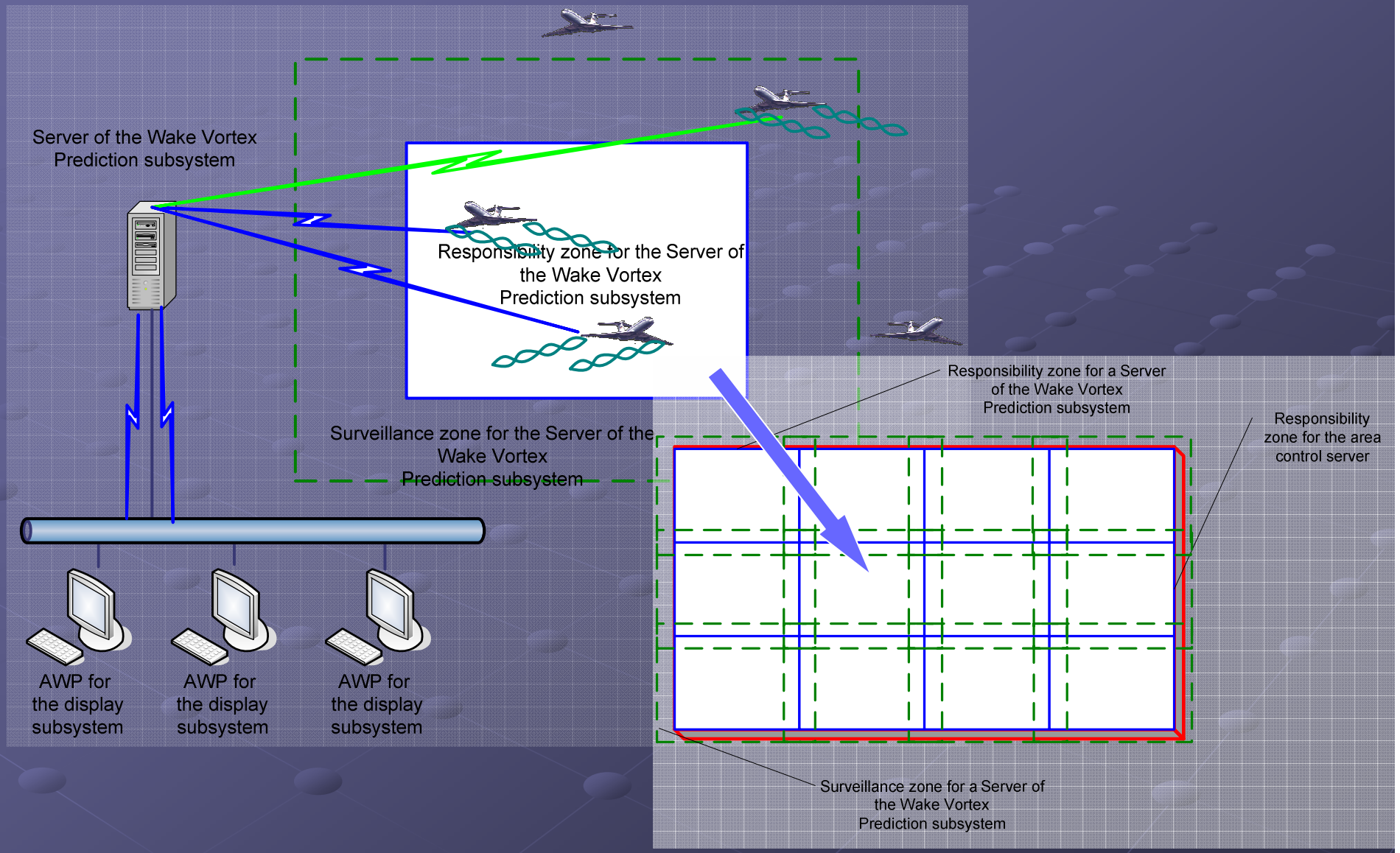


Ground-based module based on a single server for an area control center

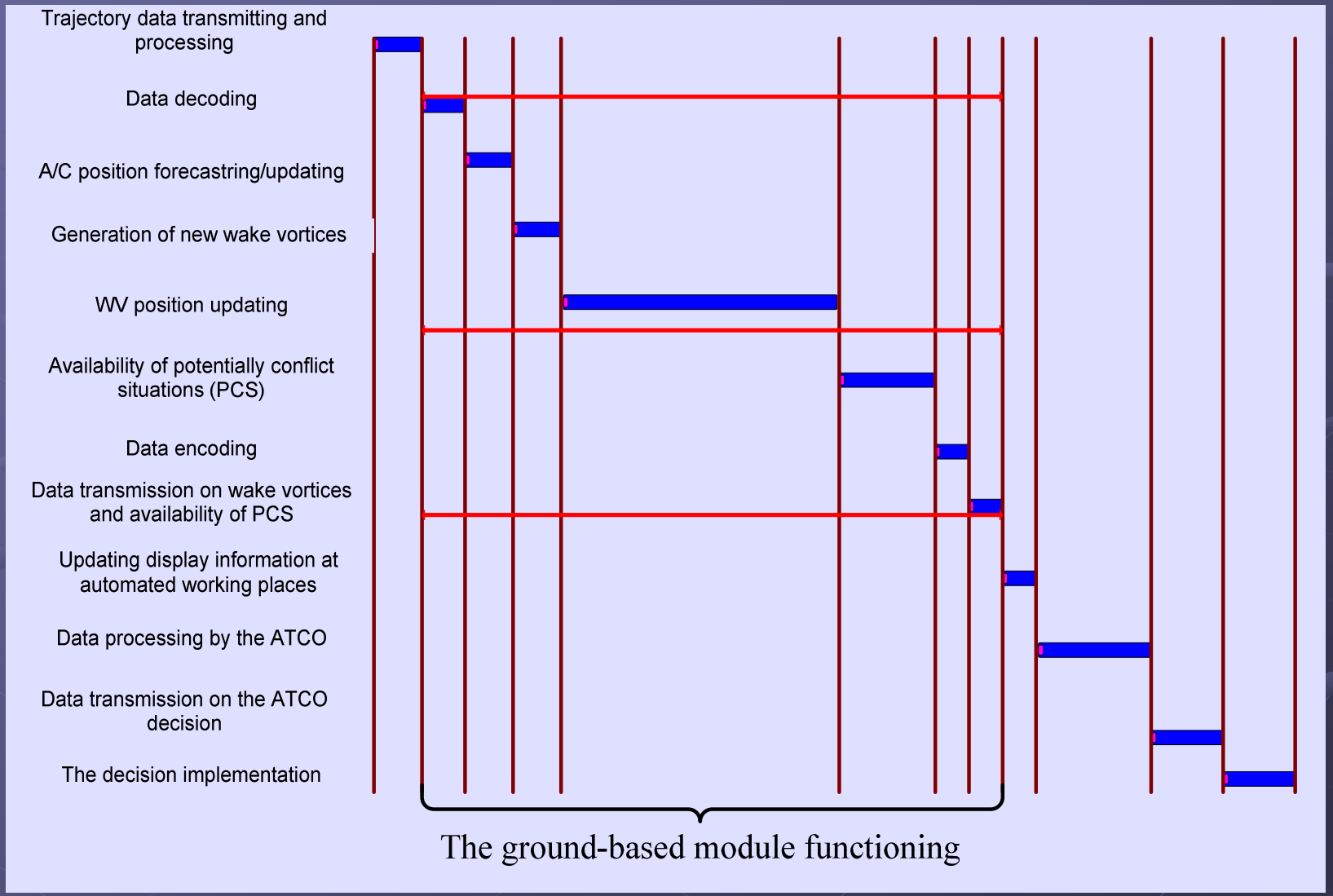


Ground-based module based on multiple servers for an enlarged area control center

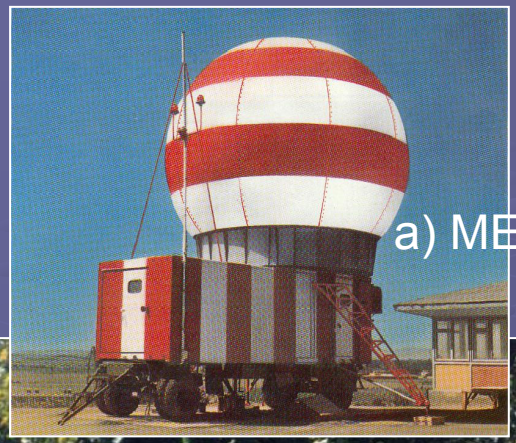
Decomposition of the Area Control Center Zone into Zones for the Ground-Based Module Servers



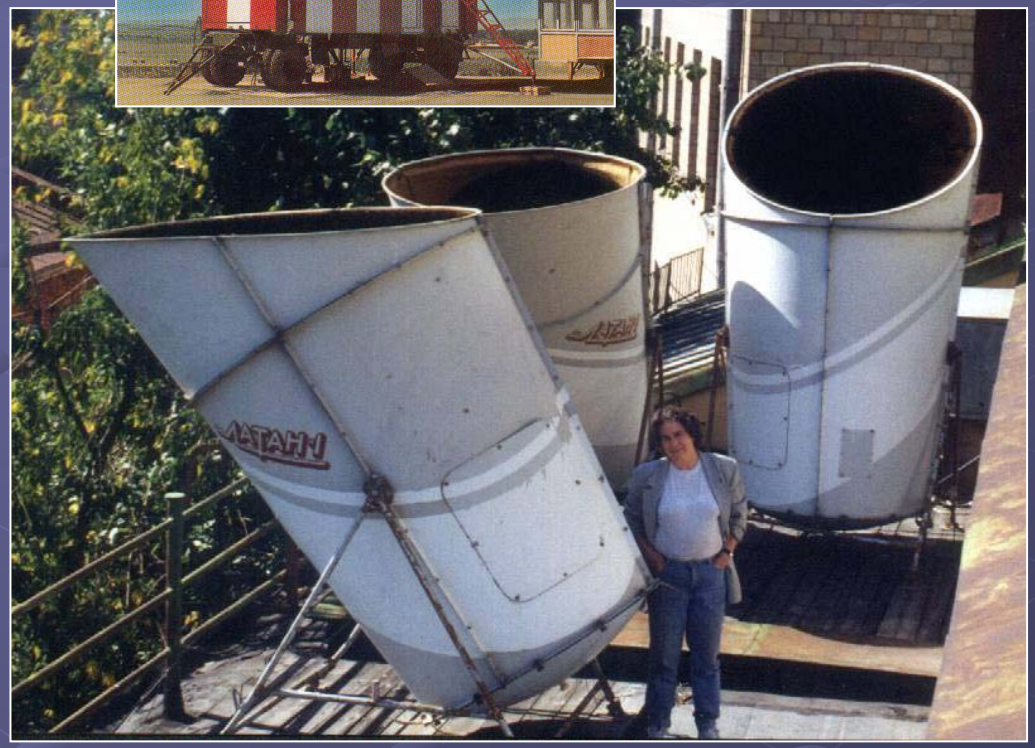
Time Sequence Diagram for the Ground-Based Module of the Wake Vortex Subsystem



Instrumental Methods for Wake Vortex Monitoring



a) MET radars

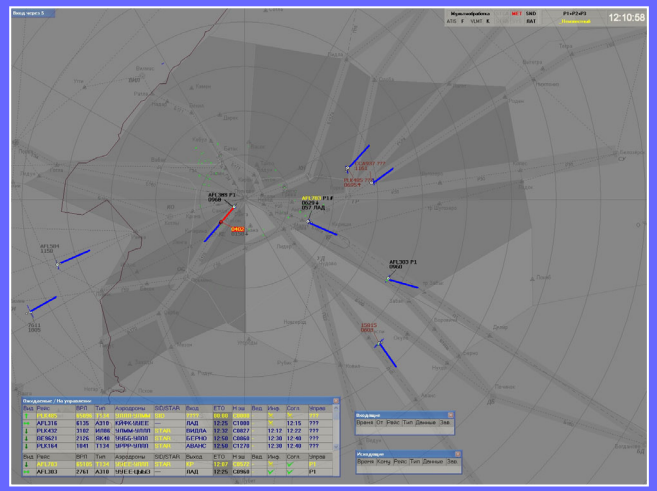


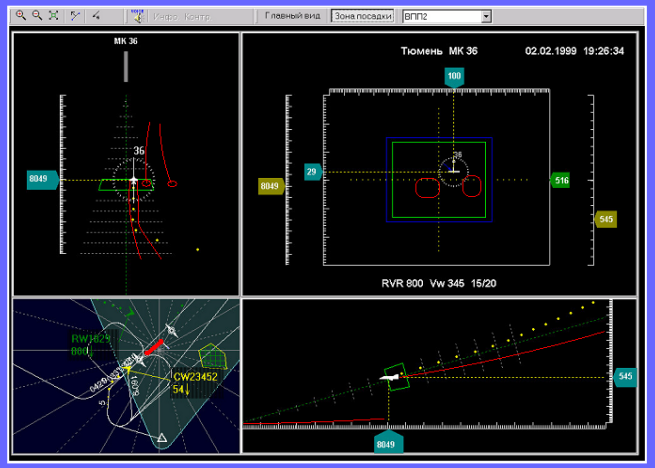
c) Sonic detection and ranging systems (sodars)

b) Laser detection and ranging systems (lidars)

Visualization of Wake Vortex Environment

ATCOs





AIRCRAFT CREW

HUD Indication

Multi-Functional Display Indication

Scheme of the Planned Experiment

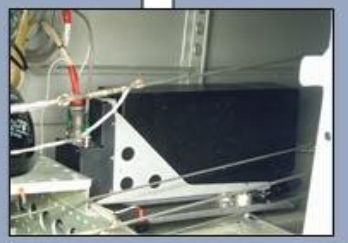
Yak-18T – wake vortex sounder

Tu-154M – wake vortex generator

ADS-B transponder

Yak-18T

1. Data acquisition for wake vortices and weather parameters
2. Wake vortex calculation
3. Wake vortex display for the aircraft crew
4. Wake vortex entering
5. Measuring aircraft parameters



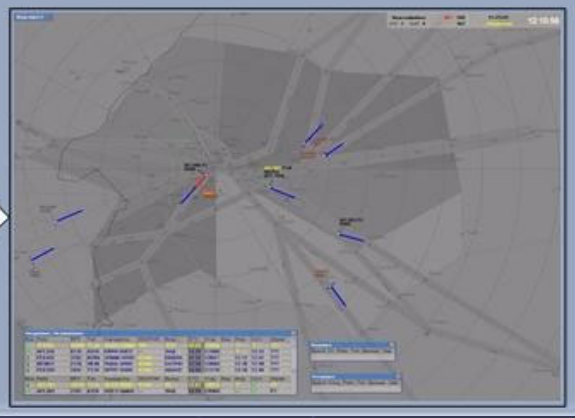
Tu-154M

1. Measuring weather parameters
2. Wake vortex calculation
3. Data transmitting
4. Smoke visualization of wake vortices

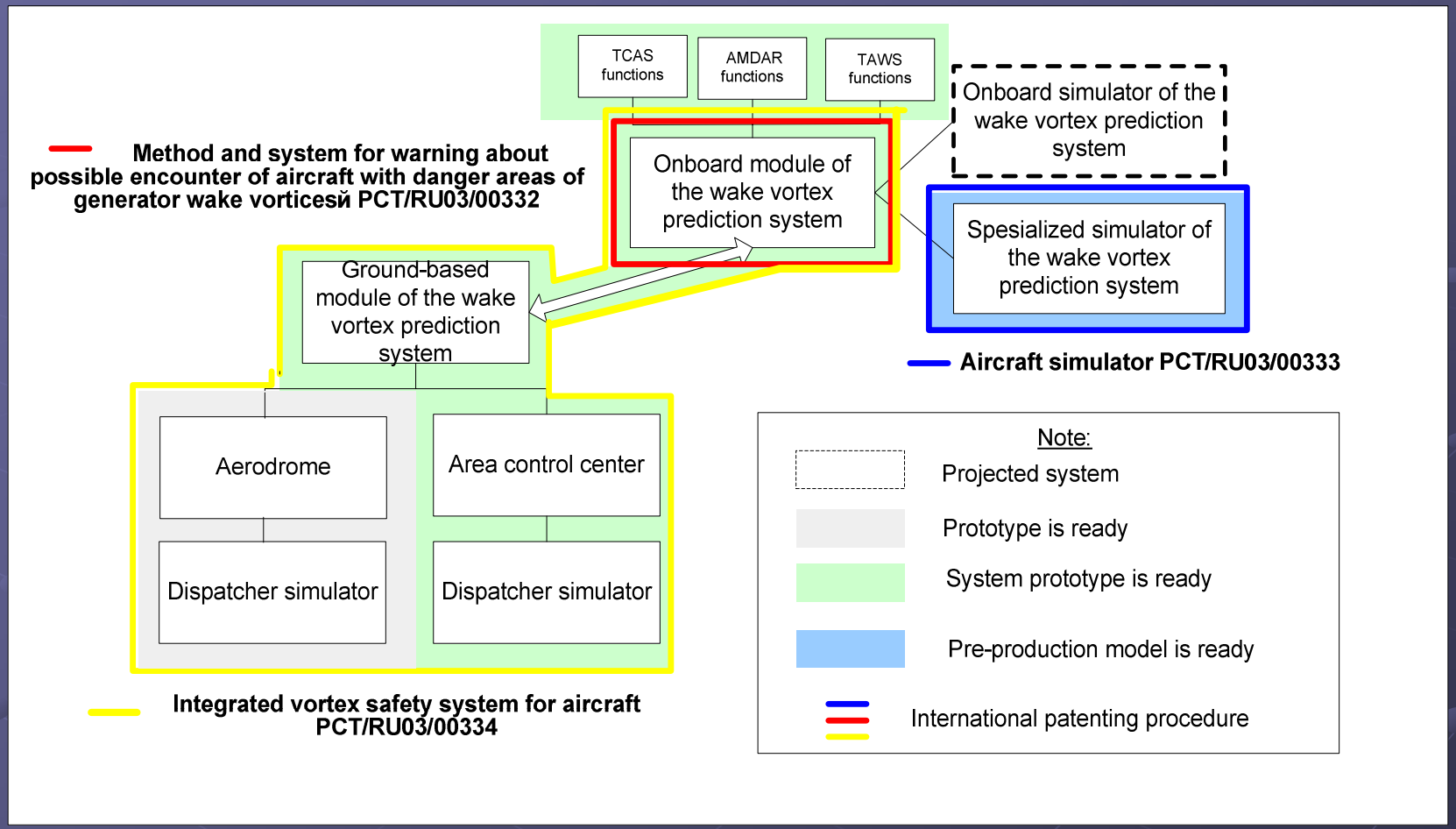
ATC control center

1. Data acquisition for wake vortices and weather parameters
2. Wake vortex calculation;
3. Wake vortex display for the ATC officer
4. Estimating potential conflict

ATC control center



Status of Russian Activities for Development of the Integrated Wake Vortex Prediction System



Development of a pre-production model for the ground-based module of the WVPS for area control centers and testing procedure – 2008
Development of a pre-production model for the ground-based module of the WVPS for aerodromes and testing procedure – 2009–2012
Development of a pre-production model for the onboard module of the WVPS for the RRJ aircraft and testing procedure – 2008–2009
New ATM procedures and series manufacturing – 2008–2019

Problems of Future International Cooperation

Proposals for changing SARPs

Aircraft equipment requirements

Aerodrome equipment requirements

Simulator requirements

Rights of utilization of production pieces

WakeNet - Europe

Integrated ATC Wake Vortex Safety and Capacity System ATC WAKE

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Integrated Wake Vortex Flight Safety System "Prediction-Sky"

WakeNet - Russia

Wake Vortex Avoidance System WakeVAS

WakeNet – USA (NASA, FAA)

WakeNet - Russia