

EUROCONTROL ADS PROGRAMME

ACTIVITIES RELEVANT TO RTCA ADS-B MASPS

Christos Rekkas
EUROCONTROL DIS/SUR

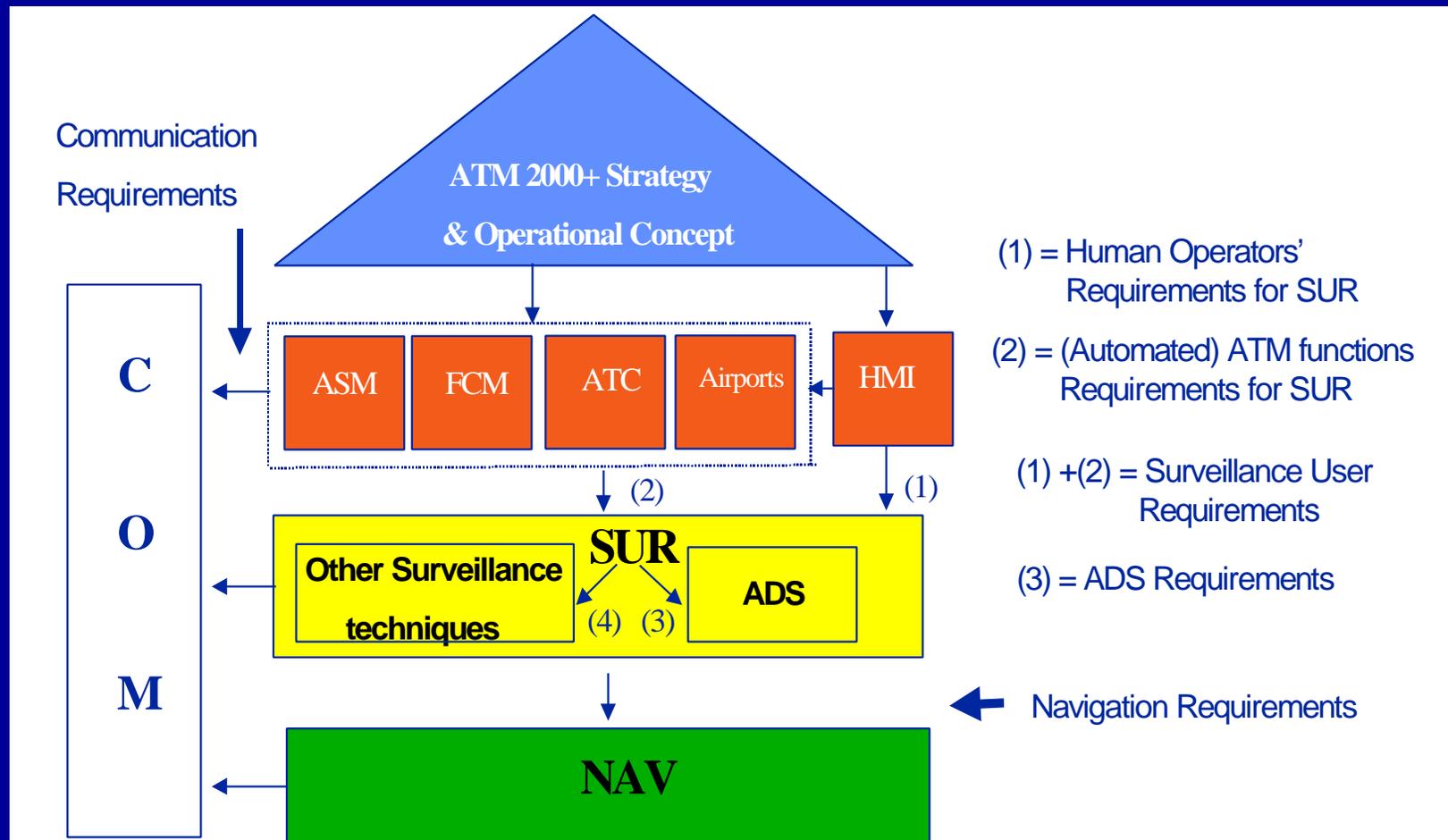


Contents

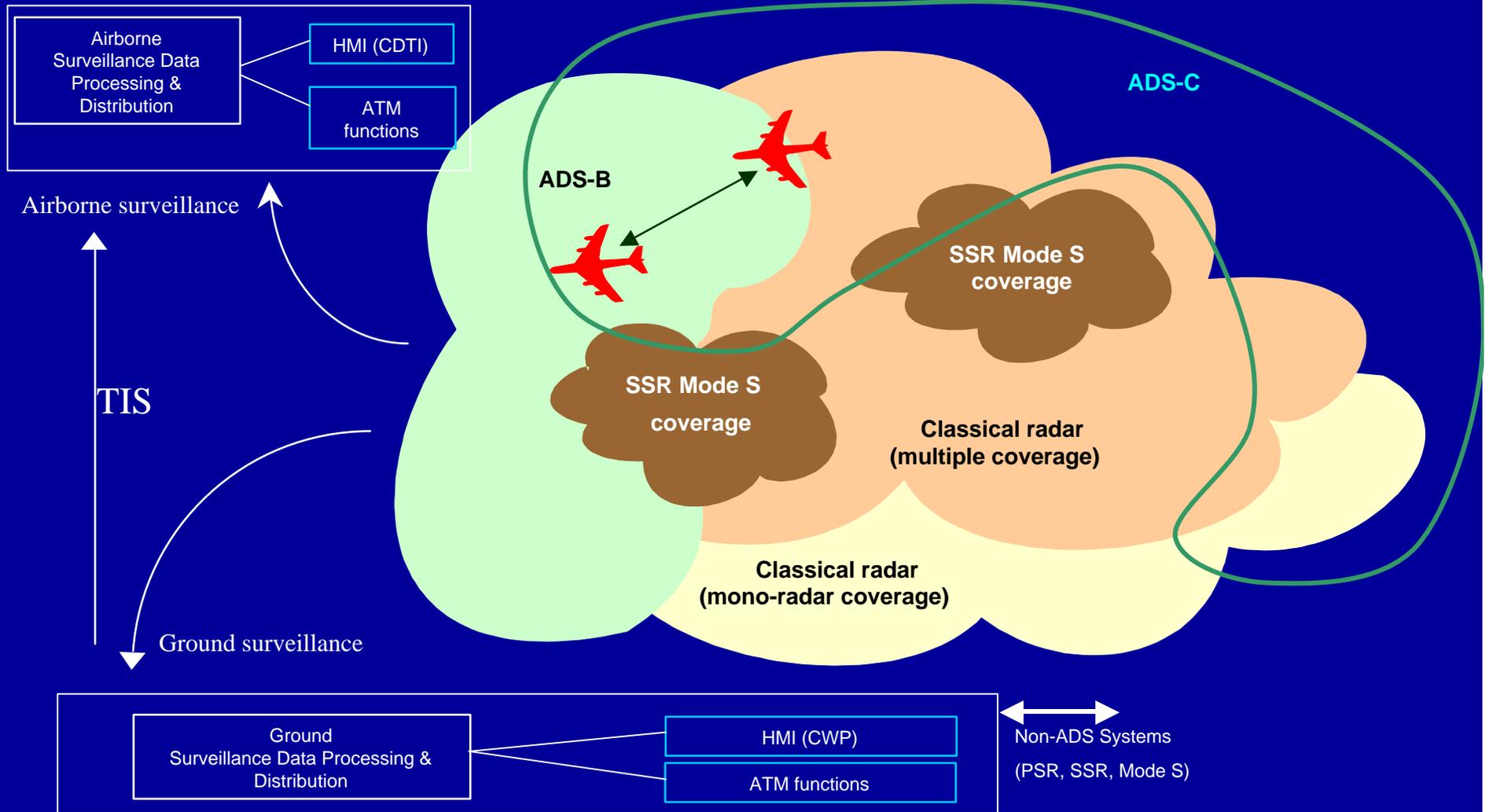
- The future Surveillance system
- The EUROCONTROL ADS Programme
- Status of the EUROCONTROL ADS-B Concept and ADS-B Requirements activities
- Relation to RTCA ADS-B MASPS
- Conclusions



EUROCONTROL ATM 2000+ Context



Future Surveillance Environment



The future Surveillance system (1)

- Enabler of ground and airborne User functions
 - Classical Surveillance (e.g. low-density Managed Airspace)
 - Enhanced Surveillance (e.g. including CAP and SAP for core area)
 - Support to Intent based ATM (e.g. ref. ARINC 702A)
 - Support to Co-operative Air Traffic Services (from basic Air Traffic Situational Awareness up to autonomous operations)
and
 - Airport Surveillance (Gate-to-Gate approach)
- Heterogeneous
 - PSR/SSR/SSR Mode S/ADS-B/ADS-C/Multilateration /TIS-B



The future Surveillance system (2)

- Provider of a Seamless and Consistent Traffic Situation Picture → Common Surveillance Information Pool
 - System Wide Information Management
 - Airborne and Ground Users
 - Flexible Services (periodic, event driven etc.)
 - Feasibility of ground Surveillance Data Processing and Distribution (SDPD) to ensure this capability for ground Users
 - Specifications and prototype system (ARTAS) developed
 - Extension towards airborne SDPD currently investigated
 - Role of TIS-B



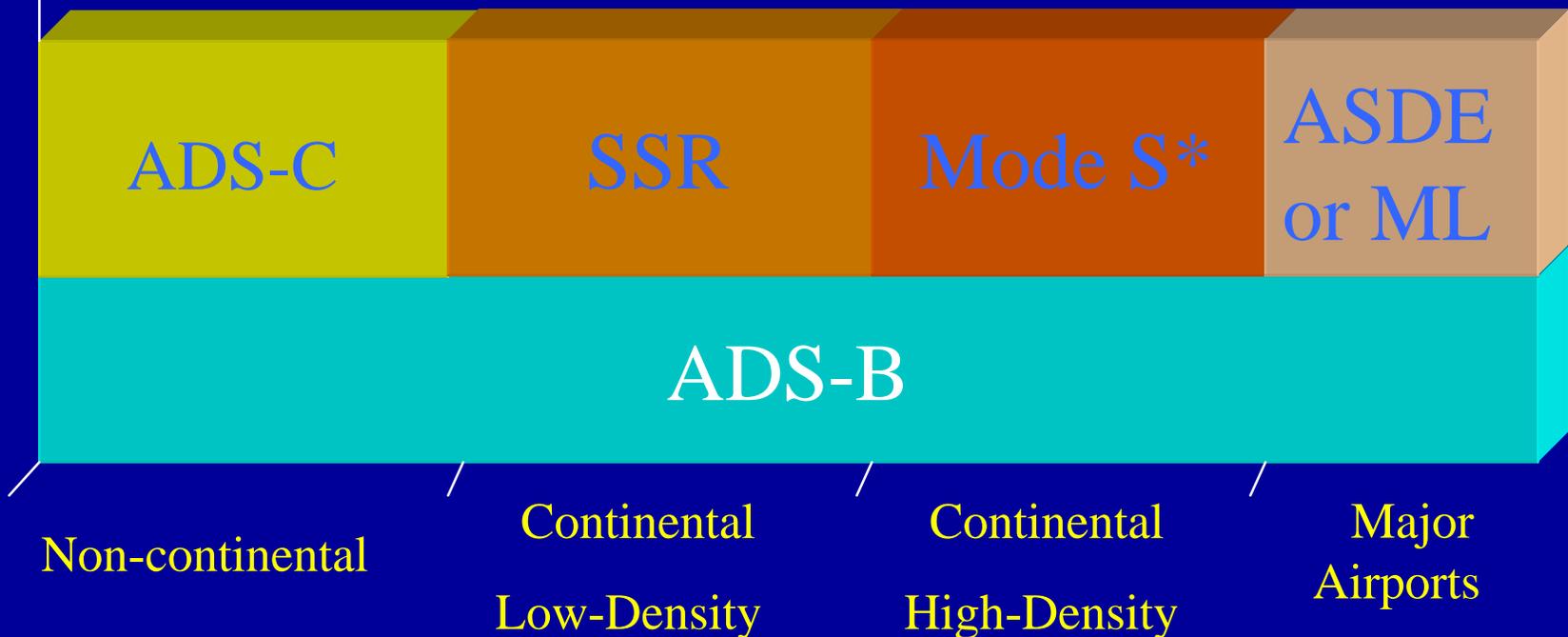
The future Surveillance system (3)

- **System** and not only ADS-B
 - Multisensor **synergies** (e.g. ADS-B/SSR and ADS-B/TIS-B)
 - Important role of **SDPD system**
 - **Multisensor Quality Assessment** function to support sensor quality checking: Specifications and prototype developed
 - ➔ Less stringent requirements on ADS-B
- Major Role for the **Trajectory Intent** information
 - **Key enabler** of conventional and future types of applications (e.g. flight path deconfliction)
 - **Information overlap** with classical state vector information (position ground speed, track angle etc.) ➔ Avoid information overflow
- ~~Reference to ARINC 702 A~~



Proposed Future Surveillance Target State (>2010)

* Double
Mode S
required by
some States



** Airborne Surveillance: ADS-B + TIS-B

*** PSR in major TMAs



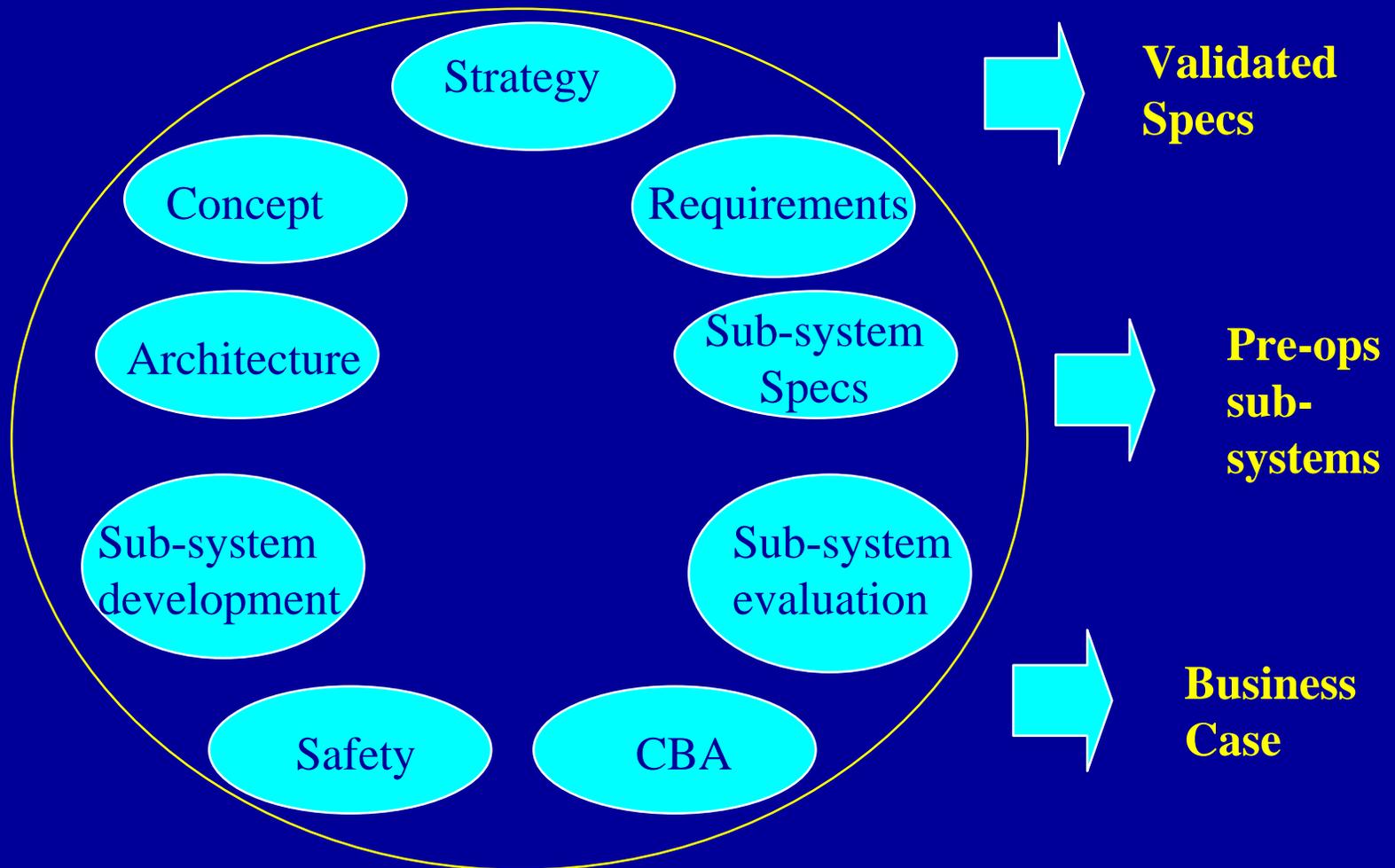
Objectives of the EUROCONTROL ADS Programme

- To execute all necessary actions to **enable** a safe and cost-beneficial implementation of ADS in ECAC
- To aim at global **harmonisation** and **interoperability** of the selected technologies

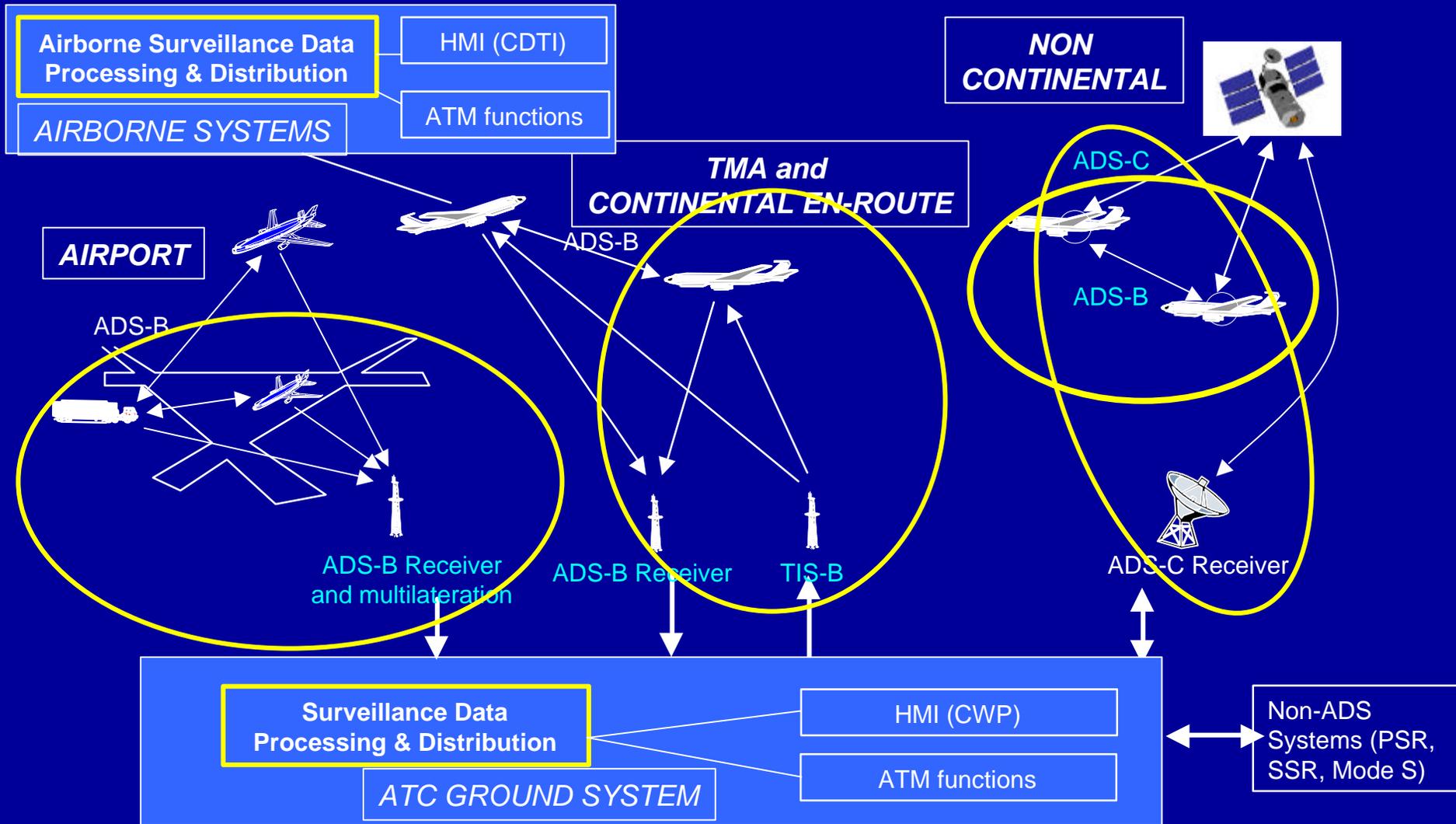
Note: The local implementation of ADS in Europe is a national responsibility and is not part of the ADS Programme



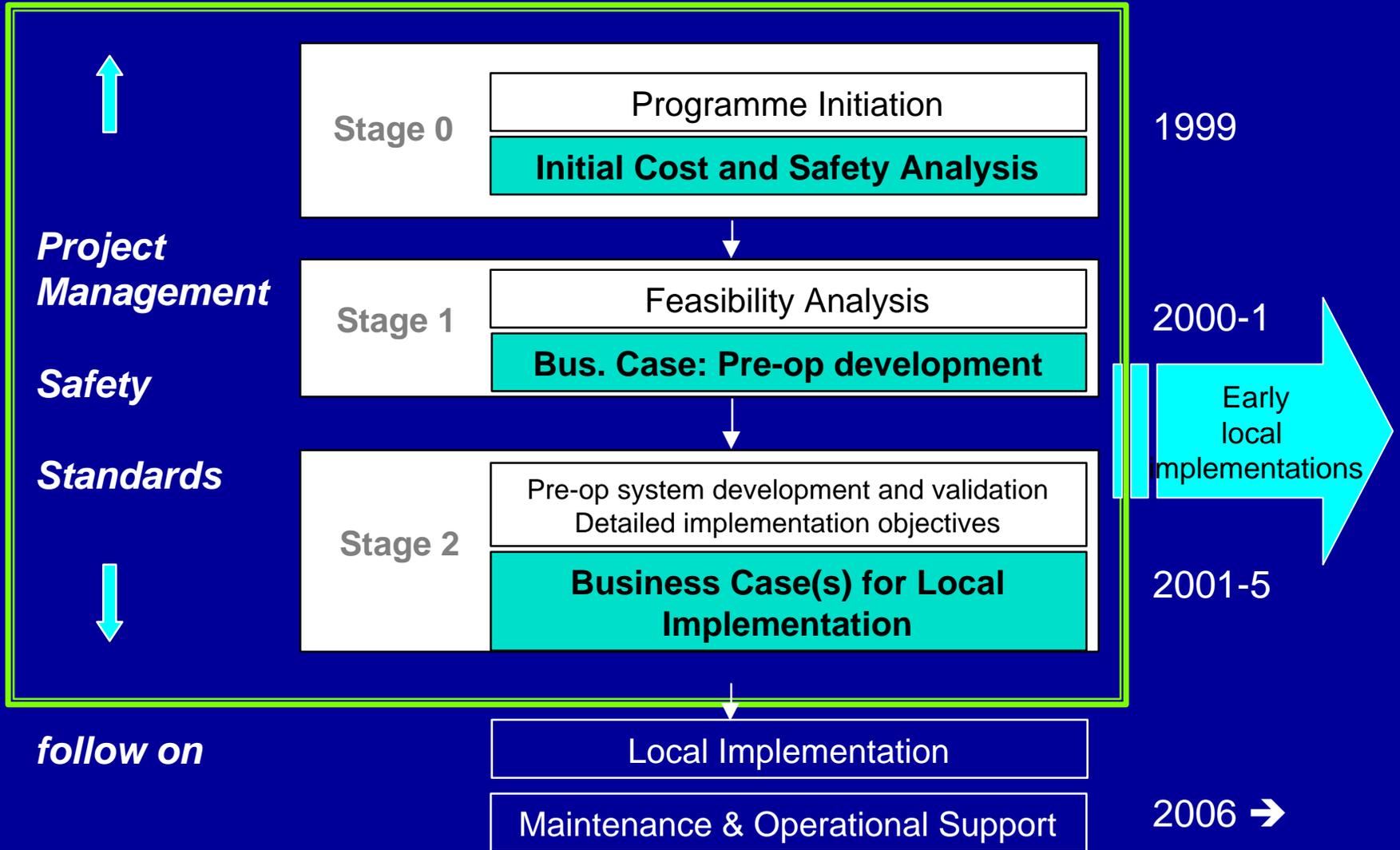
Scope of the ADS Programme



ADS Environment



ADS Programme Phasing



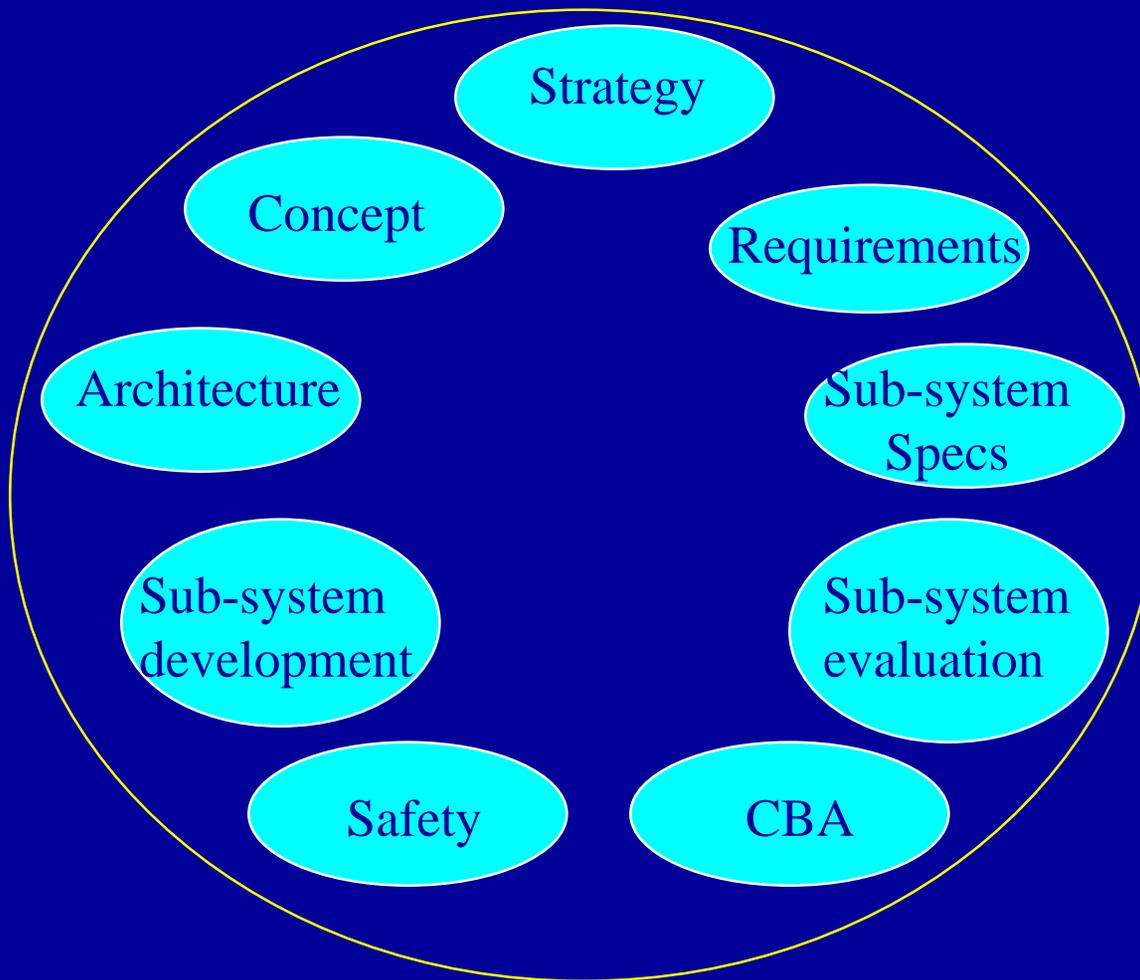
Current Status

- Stage 0 completed in March 2000
- Stage 1 is currently ongoing - Main objectives:
 - ADS Strategy, Concept, Requirements, Architecture documents
 - Initial Specifications of sub-systems, supported by prototyping
 - Validation through Feasibility, Safety, Cost Benefit, Technology Assessment, resulting in:
 - ➔ Datalink Technology Assessment Report
 - ➔ Business Case for pre-operational development
 - Co-ordination with ICAO, RTCA / EUROCAE, ARINC etc
- Target end date of Stage 1: Mid 2001



Future Plans

**STAGE 2
(2001 -2006)**



**Validated Specs
(DA, SDPD etc.)**

**Pre-operational
sub-systems**

**Business
Case**



ADS-B Concept and Requirements

Working Arrangements

- ADS Concept and Requirements TF and DG

- ➔ Airlines
- ➔ ATS Providers
- ➔ Industry
- ➔ IATA
- ➔ FAA
- ➔ EUROCONTROL

- Deliverables: Concept, Requirements, Scenarios

- Planning

- ➔ Initial Versions (Stage 0) ➔ December 1999
- ➔ Released or Proposed Versions (Stage 1) ➔ June 2001



ADS Concept scope

- Description of the **role** of ADS as an **enabler** of the future **gate-to-gate** ATM functionality
- **Scenarios** described for:
 - ➔ **Managed** Airspace (including **limited/extended separation responsibility transfer**)
 - ➔ **Unmanaged** Airspace
 - ➔ **Free-Flight** Airspace
- Includes a **proposed transition path (roadmap)** to **ADS implementation**



ADS Concept Scenarios

Components (1)

- Airspace type (MAS, UMAS, FFAS)
- Phase of flight (Gate-to-Gate)
- Supported (Surveillance User) functions
- Surveillance Service (ground and on board)
 - ➔ Class of data items and transmission characteristics
- Possible other Surveillance systems
 - ➔ PR, SSR, SSR Mode S, Multilateration
- ADS Service (ground and on board)



ADS Concept Scenarios Components (2)

- ADS role is expressed in terms of
 - ➔ Events
 - ➔ Actions/Dataflows for the main “actors” of the system:
 - ➔ Airborne Surveillance system
 - ➔ Ground Surveillance system
 - ➔ Airborne ATM function & aircrew
 - ➔ Ground ATM function & controllers

← ADS Concept Focus

ADS Requirements

Overview of the approach

- For ADS-C → ICAO Docs
- For ADS-B, the following areas are of interest:
 - Surveillance as an enabler of solely ground based separation responsibility
 - Surveillance as an enabler of air-ground co-operative Air Traffic Services
 - Managed Airspace (e.g. station keeping, simultaneous approaches)
 - Free-Flight Airspace (autonomous operations)



Solely ground-based separation responsibility

- Data Item drivers:
 - EUROCONTROL Surveillance Standard
 - Downlinked Aircraft Parameters (DAP) were defined for Mode S: DAP → CAP + SAP
 - Intent based ATM → ODIAC
- Performance Requirement drivers:
 - EUROCONTROL Surveillance Standard (classical Surveillance)
 - SSR Mode S Programme (Enhanced Surveillance)
 - Airport Surveillance system Specifications (Airport SUR)
 - Intent based ATM (by EUROCONTROL ODIAC)



Co-operative ATS (1)

- Area of Applicability
 - Managed Airspace applications
 - Enhanced Visual Acquisition
 - Station Keeping etc.
 - Free Flight Airspace applications
 - Autonomous Operations
- Currently less well defined than ground-based separation responsibility applications
- Work has started in EUROCONTROL ODIAC
 - COOPATS Concept



Co-operative ATS (2)

- Important Open Issue:

Lack of an agreed ECAC-wide set of:

- Surveillance User Applications
 - Surveillance Data Items/Transmission characteristics
 - Surveillance Performance Requirements
- However, several **important initiatives** within EUROCONTROL and elsewhere (Europe and USA)



Co-operative ATS (3)

- ICAO OPLINK Panel
- ODIAC work on Co-operative ATS Concept and Services
 - Air Traffic Situational Awareness (currently)
 - Co-operative Separation (future task)
 - Autonomous Operations (future task)
- RTCA ADS-B MASPS
- EUROCAE (exact role to be decided shortly)
- NUP Tiger Teams
- EUROCONTROL ADS Programme Case Studies
- FREER (Eurocontrol Experimental Centre)
- CARE/ASAS etc.



Applications currently considered in the ADS-B Requirements work (1)

- ATS Surveillance (incl. use of intent)
- ATS Enhanced Surveillance (incl. use of intent)
- A-SMGCS
- Enhanced Visual Acquisition
- Conflict Detection & Resolution
- Station Keeping
- Simultaneous Approaches
- Autonomous Operations



Applications currently considered in the ADS-B Requirements work (2)

- Phasing has to be discussed reflecting the applications roadmap, e.g.
 - Start from ADS-B supporting the more mature ground-based separation responsibility and co-operative ATS applications (e.g. classical and enhanced SUR, Intent based ATM and, if possible, ATSAW)
 - Then tackle ADS-B supporting the currently less mature ASAS applications
 - The details of such a phasing should be driven by the operational needs/plans

Support to TLAT

- Joint FAA/EUROCONTROL Technical Link Assessment Team
 - Assessment of candidate ADS-B technologies (and combinations of them)
 - 1090 Extended Squitter
 - VDL Mode 4
 - UAT
- Based on the following material:
 - RTCA ADS-B MASPS and
 - EUROCONTROL ADS Programme criteria (additional to RTCA MASPS)



Overview of initial remarks on RTCA ADS-B MASPS

- Initial issues
 - Applications
 - ATS Surveillance (for MAS low-density)
 - ATS Enhanced Surveillance (for MAS high-density)
 - Intent-based ATM
 - A-SMGCS
 - Data Items
 - Controller Access Parameters (for MAS high-density)
 - More than next and (next + 1) Trajectory Intent Points
 - Transmission Characteristics
 - Event driven transmission



ATS Surveillance

- Based on EUROCONTROL Surveillance Standard
- For *Low-Density Airspace*
- Similar to the currently provided ground-based Surveillance application
- To be probably extended with Intent based ATM



ATS Enhanced Surveillance

- Similar to the application considered in the EUROCONTROL Mode S Programme
 - Decision on Mode S Enhanced Surveillance in Europe expected very shortly
- For High-Density Airspace
- Additional Components
 - Controller Access Parameters
 - Mode S Programme performance baseline
- To be probably extended with Intent based ATM



Intent based ATM

- Ground based applications supported by intent data, e.g. Flight Plan Consistency or MTCD
 - Work by EUROCONTROL (ODIAC etc.)
- The number of TCPs required is expected to be higher than the TCP and TCP+1
 - ADS-B compared vs other enablers
- Exact definition of intent is under discussion
 - Various activities world-wide
 - Reference to ARINC 702A



Airport Surveillance

- Currently, several activities towards implementation of Airport Surveillance are ongoing
 - Europe
 - USA
- The corresponding specifications to be studied as input material

Data Items

- CAP (required by controllers in MAS High-Density Airspace)
- Provision of more than two TCPs is under investigation (feasibility/timing/range etc.)
 - Intent based ATM
 - Supporting Flight Plan and conflict related functions on the ground
 - CD&R (long range)
 - Autonomous operations
 - At least four required for TLAT (up to TCP+3)



Transmission characteristics

- Event driven transmission combined with low rate periodic transmission
- Event type: Change of the data item
- Interesting for TCPs

Open Issues (1)

- **System view** instead of ADS-B only
 - Multi-sensor environment (ADS-B/SSR, ADS-B/TIS-B etc.)
 - Multi-sensor fusion
 - Surveillance Quality Assessment (integrity check etc.)
 - Systematic errors
- **Operational range** of some applications
 - CD&R, Autonomous Operations etc.
 - Number of TCPs required
 - 150 nm proposed for autonomous operations in TLAT



Open Issues (2)

- Information overlap between TCPs and state vector information
 - Are **all** items needed in **every** report ?
 - Availability/quality/processing of TCPs on board
 - Nr. of aircraft supporting the TCPs
 - Impact on the data link load
- Split of **CD&R** as a function of range
- ADS-B and **ACAS**
- **Performance Requirements** check
 - Double Surveillance layer + SDPD



Approach to be followed (1)

- Prioritise the applications driving the proposed changes
 - Classical SUR
 - Enhanced SUR
 - Intent based ATM
 - Initial Co-operative ATS applications (if available)
- Identify the specific changes to be proposed
 - Data items
 - Transmission Characteristics
 - Performance requirements
 - Other



Approach to be followed (2)

- Consolidate with stakeholders, as much as possible
- Perform investigation to resolve open issues
- Co-operation with EUROCAE to be defined in detail, based on the decision on their participation in the work



Conclusions

- EUROCONTROL ADS-B Concept and ADS-B Requirements work is in progress
- Initial issues w.r.t. the RTCA MASPS revision
 - ATS Surveillance, Enhanced Surveillance, Intent based ATM and A-SMGCS
 - CAP and at least four TCPs
 - Event Driven Transmission (e.g. for TCPs based on change and combined with low rate periodic)
- Open Issues under investigation (e.g. multi-sensor aspects ADS-B/TIS-B or SSR, range of some applications, TCPs and state vector, etc.)

