OUTLINE

I – Overview

II – Contract

III – Architecture

IV - ADS Functional objectives and services

V - Conclusions
Surveillance definition

provision of data and information with quality required for:

– identification of all aircraft
– representation of their accurate position and kinetic characteristics

as needed for Air Traffic Management.
A.D.S.
Automatic Dependent Surveillance

- Automatic: aircraft reports without intervention
- Dependent: position communicated is determined on board the aircraft,
- Surveillance: purpose is to allow the observer to know the position of specific aircraft on the ground,
ICAO Definition

A surveillance technique in which aircraft automatically provide, via a data link, data derived from on-board navigation and position-fixing systems, including:
- aircraft identification,
- four-dimensional position,
- additional data as appropriate.

ADS is a data link application.
SURVEILLANCE - ADS Reports

A- Basic ADS report
   Latitude, Longitude
   Altitude, Time
   Figure Of Merit (F.O.M)

B- Ground Vector
   True Heading
   Ground Speed
   Vertical rate

C- Air Vector
   Heading
   Mach number
   Vertical rate

D- Meteorological report
   Wind speed
   Wind direction
   Temperature
   Turbulence

E- Flight identification
SURVEILLANCE - ADS Reports

E- Flight identification

F- Projected Profile
Next Waypoint (WPT)
Estimated altitude at next WPT
Estimated time at next WPT
Next + 1 WPT
Estimated altitude at next + 1 WPT

G- Short -term intent
Latitude at projected position
Longitude at projected position
Altitude at projected position
Time of projection
I- Extended projected profile

Next WPT + Altitude + Estimated time
Next +1 WPT, Altitude + Estimated time etc...
Next + 128 WPT, altitude + Estimated time
SURVEILLANCE - ADS Contracts

A contract = agreement between air and ground on information to transmit to the ground.

Three types of contract defined:

A- Periodic Contract
ADS basic group (interval T) + a set of additional groups with for each group a reporting rate defined as multiple of the basic reporting

B- Demand Contract
Basic group + a set of additional groups

C- Event Contract
Basic Group with a flag to indicate the event triggering the report
Details on Periodic Contract

1. **PERIODIC CONTRACT REQUEST**
   - Reporting rate: 5 minutes
   - Met Group 5
   - Short term Intent 2

2. ACKNOWLEDGEMENT
   OR
   NEGATIVE ACKNOWLEDGEMENT
   OR
   NON COMPLIANCE NOTIFICATION

3. **BASIC GROUP + SHORT TERM INTENT + MET GROUP**

4. **BASIC GROUP**

5. **BASIC GROUP + SHORT TERM INTENT**
Details on EVENT contract

When this contract is set up reports containing the basic group are sent when the event defined occurs

Pre-defined Events are:

- **Passing of:**
  - a WPT
  - a specified altitude
  - a specified longitude
  - a specified latitude

- **Change of:**
  - next or next + 1 WPT
  - heading
  - altitude
  - speed (ground/air/vertical rate)
  - F.O.M.

- **Deviation** from the cleared route or altitude
ADS Contracts - Specifics

In addition an Urgent Mode can be initiated by the pilot:
Transmission of basic group with a pre-defined reporting interval + aircraft Identification

An aircraft can support up to 4 contracts with 4 ATS different ground systems (access control)

Theoretical reporting rate can vary from 1s to 30 minutes (avionics specs (64 sec typical))
ADS connection establishment

- Identification of the ADS capability of the aircraft by ground system
- Establishment of a data link between aircraft and ground system
- Comparison of the aircraft 3D profile with ground flight plan
- Identification and allocation of the appropriate ADS contract
ADS technical architecture and context
ADS end to end technical architecture
Air architecture: a system approach

- **GPS Navigation**: UTC synchronised time (Time stamping), Required Navigation Performance certification (RNP4)

- **AFN (Logon)**: HANDSHAKE
  Aeronautical Facility Notification

- **CPDLC**: Controller Pilot Data Link Communication

- **ADS-C**: Automatic Dependant Surveillance - Contract

- **AOC**: Airline Operational Communication

- **RTA**: Required Time of Arrival
FANS-1 /A
combined CPDLC/ADS operational concept
expected benefits

- Safety: Improve pilot-controller communications

- Economy: Optimum routes "Flextracks" based on wind forecast
  Single and then multiple re-routings per day

- Capacity / Economy: Reduction of separation standards
  15 minutes longitudinal
  100NM lateral → 50NM → 30NM
Functional objectives

- **Data Link Application** toolbox

The notion of "Data-Link Application" has been defined by ICAO Manual of ATS datalink applications doc 9694-ed1-99 as: "the implementation of datalink technology to achieve specific Air Traffic Management operational functionalities".
ADS FUNCTIONAL OBJECTIVES

a) Increase flight safety, through the capability to provide surveillance services to aircraft outside radar coverage. Oceanic -remote areas

b) Better notification and increased accuracy of the aircraft position in emergency situations.

Search and Rescue operations eased

c) Complement to radar (low altitudes, radar failure)

Not an alternate to radar, just a complement
d) Early detection of waypoint insertion errors
e) Reduction of separation minima in procedural airspace (still argued for FANS)

f) Enhanced conflict detection and resolution capabilities

g) More flexible use of airspace due to the increased level of tactical control
h) Flight path monitoring and early detection of deviation from the cleared route
ADS based services- Definition

- **Data Link Service = one use of tools**

  The notion of "Data-Link Service" has been defined by ICAO Manual of ATS datalink applications doc 9694-ed1-99 as: "A set of ATM related transactions, both system supported and manual, within a datalink application, which have a clearly defined operational goal".
ADS based services - List

• Conformance Services
  – Flight Plan (Route) Conformance (FLIPCY)
  – ADS Conformance Monitoring
  – Automatic Distance Verification
  – Dynamic Air Route Planning (DARP)

• Controller Access Parameters Service
  – Baseline 1 CAP Service
  – Turbulence Downlink Dialogue
CAP functional objectives

CAP Controller Access Parameters is the service
DAP Downlink of Aircraft Parameters is the sub-application

- High level objectives:
  - Increasing traffic capacity per sector
  - Increasing safety by reducing both controllers’ and pilots’ workload
  - Decrease of R/T channel congestion
  - Better controllers’ traffic and meteorological situation awareness

- 3 main DAP-enhanced tools envisioned:
  - Enhanced controller tools in en-route airspace
  - Enhanced surveillance in non-radar, low-density airspace; and
  - Enhanced support tools for arrival management at major airports.
CAP benefits & constraints

- **Expected Benefits**
  - direct provision of up-to-date aircraft parameters to the Controller,
  - reduction of the risk of error,
  - extension of the domain of common reference for Aircrew and Controller,
  - improvement of the capacity of pre-regulation (e.g. sequencing) in terminal sectors,
  - reduction of the Controller workload by reducing uncertainty concerning expected behaviour of the aircraft,

- **Anticipated Constraints**
  - transmission delay (air-ground and airborne).

- **Associated Human Factors**
  - An appropriate Controller Human Machine Interface
  - Impact on cockpit Aircrew procedures with regard to Aircrew selected altitude.
Thank you for your Kind attention!
Any Question????