Airborne Separation Assistance Systems (ASAS) - Summary of simulations

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- Radar airspace
  - Simulations of airborne spacing merge and remain behind in TMA
- Non-radar airspace
  - Simulations of air traffic situational awareness for oceanic step climbs
Introduction (1/2)

- Automatic Dependent Surveillance - Broadcast (ADS-B) invented 1980s.
- 74% of flights in Europe equipped with ADS-B Mode S extended squitter of which 79% broadcasting position (Eurocontrol, August 2007)
- Benefits:
  - Surveillance cost 1/10 of ground based radar -> reduced navigation service charges ~30%
  - Wider coverage – niche areas too expensive for ground radar
  - Increased efficiency of flight operations enabled by airborne separation assistance system
Airborne Separation Assistance System (ASAS)

- 2007: > 80 ASAS applications identified (Eurocontrol/FAA)
- Example ASAS applications with early benefits:
  - Airborne spacing merge and remain behind in TMA
  - Airborne traffic situational awareness for oceanic step climb

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Motivation

- Improve the sequencing of arrival flows through a new allocation of spacing tasks between air and ground
- Neither “transfer problems” nor “give more freedom” to pilots … shall be beneficial to all parties

Assumptions

- Air-air surveillance capabilities (ADS-B)
- Cockpit automation (ASAS)

Constraints

- Human: consider current roles and working methods
- System: keep things as simple as possible
- Development and refinement of spacing instructions and working methods
- Identification of required functional evolutions (air and ground) and route structure

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Assessment of feasibility, benefits and limits
- Representative environment with very high traffic
- From cruise to final approach
- Nominal and non nominal conditions (mixed equipage, go-around, emergency, radio failure, airborne spacing error, ...)
- Controller, pilot and system perspectives

Large panel of participants
- Controllers from various ANSP (AENA, DSNA, ENAV, IAA, LFV, NATS, NAV-EP)
- Pilots from Airbus and various airlines (DLH, CTN, ...)

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EUROCONTROL-DSNA Project, October 2005 – February 2007
Evaluation of operational benefits of airborne spacing sequencing and merging for Paris Arrivals

Charles de Gaulle North – partial equipage – time gain
A new RNAV route structure?

- A preliminary step to prepare implementation of airborne spacing
- A transition towards extensive use of P-RNAV
- A sound foundation to support further developments such as CDA (continuous descent) and 4D (target time of arrival)
Merge and remain behind in TMA (6/6)

- Point merge preliminary fast-time simulation results (RAMS platform)
  - 4 Initial approach fixes
  - 1 runway
  - 1 hour traffic ~30 aircraft with 20% heavy/80% medium mix
  - 2 controllers
  - Continuous descent approach from 12,000 -> 3,000 feet
  - Distance range 60-90 NM

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Oceanic step climbs (1/3)

- Crew request a step climb with airborne traffic situation awareness

ATSA-ITP Criteria
- Aircraft at FL340 would like to climb...
- But standard longitudinal separation does not exist at level above
- Crew request a step climb with airborne traffic situation awareness

ASSTAR step climb with airborne traffic situation awareness
- Today over North Atlantic average 0.2 step climbs per flight recorded
- Fast time simulations show with airborne traffic situation awareness
  - number of step climbs per flight could be 2 or more.
  - ~75% of climb requests could be satisfied immediately and at least 93% satisfied eventually.

ASSTAR fast time simulations
Oceanic step climbs (3/3)

- **Costs**
  - Implementation costs per aircraft
    - 45,000 € retrofit
    - 35,000 € forward fit
  - Maintenance costs per annum
    - 1,200 € retro fit
    - 1,500 € forward fit

- **Benefits**
  - 150 Kg fuel saved per single oceanic transition
  - 54,000 € per aircraft per year
  - 0.6% reduction in emissions

- **Payback period**
  - 0.9 years retro fit
  - 0.7 years forward fit

(Assuming 2 transitions a day and 0.5 € per kilogram)

Cost benefit analysis by BAE Systems D5.3 (http://www.asstar.org/)