Meeting for ADS-B Focus Group
Boeing offices, Washington DC
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Attendee's:

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Claudia Gerstle opened the meeting by reviewing the ADS-B Focus Team objectives. The team needs to complete a cost benefit analysis of the most important ADS-B applications by November. Today we must come with a plan to meet this objective. We need to identify the most important ADS-B applications and prioritize them. In addition the team must prepare a 20 minute status presentation for the upcoming C/AFT Core Team meeting in Paris. Boeing first facilitated the C/AFT group but C/AFT is led by the airlines.

Ed Porisch was introduced as the Boeing Focal for the ADS-B Focus Team and outlined a plan for reaching the November objective. To produce a meaningful cost/benefit analysis by November the team needs to limit the scope of the analysis. Although it would may be desirable to use or develop a sophisticated analysis tool for this effort we don't have the time or resources to do so within this short time frame. Instead, for each ADS-B application that we choose to analyze, we need to make a good estimate of the benefits and costs. These benefits and costs need to have an uncertainty associated with them. The financial people at the airlines are not going to invest in applications, even if the benefit exceeds the cost, if the risk associated with benefits and costs is excessive. Some ADS-B applications won't involve as much cost and risk as others. These lower risk applications may serve as stepping stones to other ADS-B applications and serve to reduce the risk of follow-on ADS-B applications. Ed also suggested that the team choose a relatively simple first ADS-B application to develop a cost/benefit template that could then be modified and applied to more complex applications.

The team needs prioritize the ADS-B applications and in doing so must consider cost and risks associated with the applications. For example,

- Certification risk, criticality of airborne equipment
- Impact on ATC ground procedures
- Impact on ground infrastructure
- Flight crew procedures
- Flight crew training
- Controller procedures
- Equipment cost

- Crew training

Bob Hilb suggested that impact on ATC procedures may be classified as moderate risk if it did not impact ground infrastructure and applications that impact ground infrastructure are high risk and those that only impact crew procedures are lower risk.

Applications on a global scale or just US? We need to think globally, not just US analysis. We also need to consider general aviation, all possible users.

Rudy Schwenk suggested use of ADS-B and CDTI for taxiing purposes, SAS looking at ADS-B for approaches in order to stagger aircraft for peak operations, use of CDTI in the cockpit integrating radar for non equipped aircraft, free flight airspace regime - autonomous aircraft separation in the far term for ATM concept. Is this last application ACAS? No, there are many enhancements that can be made to ACAS to fix it. Right now we can look at ACAS as a possible application.

Issues of interoperability. Some may require spacings and procedures that will trigger the ACAS alert as it has been defined. May require modifications to the current ACAS logic. Make sure to keep distinction between collision avoidance and separation assurance.

Many applications are common to US and European communities. Perhaps we should concentrate on near term and things that we can describe with some certainty and limit the scope. Do not try to consider the far term.

Model and methodology that each airline can use? Original goal was to affect some consensus among the community. Affect the political environment at high levels but with sophisticated modeling. Come up with a shared model that airlines could plug their own numbers into.

On data link applications, group of applications that would be near term, mid term, long term. The highest fidelity analysis would be for the short term. You don't want to let go of the far term issues, because it will lead you in the analysis but not spend too much time on it since we don't have so much information.

IFR parallel runway application that NASA has been working on has had a lot of research done on it but it is more long term than the VFR parallel runway application. We should probably keep all the applications in there so we don't lose them, but we should make sure that the first application that we do is a relatively easy one that we can use as a template.

This group should also build some political consensus? Our work product will allow us to move into that environment more quickly than we have in the past. In the US, we may have more problems bringing in infrastructure into the system. For the European case, in terms of the magnitude, the risk of introducing infrastructure may be different.

The group agreed that we will look at both short term and long term applications.

How do we do this? We need to prioritize a fairly complete list of applications.

The ADS-B MASPS has 80 applications. There were 14 in the SAS SRT group. Application of oceanic and non radar environment. The group decided to use the SAS SRT applications.

<u>ADS-B Applications</u>

Assumptions:

ADS-B only
do not double count benefits – what is an ADS-B benefit, what is a data link benefit
we will list the safety benefits but not quantify them

have been focusing on capacity, efficiency benefits not safety

1. Non-radar separation assurance (radar substitute) (pseudo radar air-ground)
   To put a radar functionality where there isn't radar today.
   ADS-A could also do this
   use of ADS for ground based separation
   radar substitute - incremental capacity benefit with ADS-B?
2. Conformance monitoring for parallel approaches (inexpensive implementation of PRM) (combined with 9) (high benefit)
3. In-trail climb/descent; ground separation track system(combined with 4 and 5) (high benefit)
4. Station keeping (procedural and cockpit based separation) (combined with 3 and 5) (high benefit)
5. Passing (combined with 3 and 4) (high benefit)
6. Traffic situation awareness (combined with 7) (safety only)
7. Enhanced visual acquisition for see and avoid (no alert) (combined with 6) (safety only)
8. Enhanced visual departures and approaches with visual separation (pilot responsibility) (high benefit)
9. Parallel approaches VMC down to IMC (high benefit) (combined with 2)
10. Traffic situational awareness on the surface for marginal VMC (aircraft and ground vehicles) not a driver (safety with ADS-B) (other technologies/same benefits?)
11. ADS-B self separation where feasible (air-air; spectrum from close-in to strategic; both collision avoidance and separation assurance (high benefit) where feasible?
    a) detection
    b) resolution
    c) …
12. ADS-B improvements to TCAS/ACAS (safety only)
13. Enhanced visual acquisition in VFR traffic pattern (safety only)
14. Improved conformance monitoring/reduced separation standards (air-ground and air-air)
    Velocity component (tactical)
15. Traffic Management Enhancement via ADS-B input to ATM tools (better trajectory prediction). What is the increased benefit from ADS-B? should be on the list of data link applications; not a killer application; hard to do (Not so tactical)

Within IATA and Eurocontrol, there has been an effort to kept safety out of the cost/benefit analysis. A quantitative assessment of safety can bias the analysis depending on the cost assigned to a human life. Can do analysis to bias any analysis depending on the cost of a human life. The group decided to identify the safety benefits but not quantify them.

Discussion on categorizing of:
Near term: air to air only, minimal impact on ground procedures (1-5 years)
Mid term: changes to procedures (5-10 years)
Far term: ground infrastructure (10+ years)

High benefit, medium benefit, low benefit and then rank by near term, mid term, far term.

Combine 3, 4, and 5 (discrete events)
Combine 6 and 7
Combine 2 and 9

From the above combined applications, the group chose the following four applications to include in the November analysis:

- Enhanced Visual Approaches and Departures (item 8)
- Discrete Events in Non-radar Environment (combination of items 3, 4 and 5)
- ADS-B Self Separation (item 11)

- Parallel Approaches (combination of 2 and 9 above)

Enhanced Visual Approaches and Departures was chosen as the initial application for the team's cost benefit analysis. MITRE has a tool for the top 25 airports in the US; good weather data for 1996; DPAT model. Run baseline using existing airport capacities, case for change in airport capacities for enhanced visual approaches. Uses OAG to develop demand model. Study in progress. Don't have a set of capacities or ceiling and visibilities developed. Want to vary equipage levels. The as-is baseline they are taking by interviewing controllers. Can set up the model, build the structure, for number application 8. MITRE's updated document is on the C/AFT web site: www.boeing.com/caft/focus groups/ADS-B/documents.

2 +9: has a very similar structure to 8.

Should we do a US case, a European case? Aggregate it but also keep in mind separate airport delays.

Economic model - change passenger satisfaction to customer satisfaction.

MITRE might be able to do some analysis in Europe, but will need some help on current practice. Has that work already been done? We need to check with our European contacts to see if this has been done.
Individual airports versus system analysis . Propagation of delay is taken into account in DPAT. Model doesn't account for cancellations. Output of DPAT is delay numbers per aircraft, can aggregate it in different ways. Higher performance version of NASPAC.

Capacity improvement - delays for US, might be available for Europe - DPAT Do we need to model diversions? Cancellations, diversions to large delay is not taken into account in DPAT. We can say that we're going to consider delay and recognize that there are diversions and cancellations but we won't model them.

Converting delay data to fuel and time savings. Model will show some delta time. IATA data for fuel; ATA number for fuel. Two cost benefit studies one for US and one for Europe. We can get numbers from ATA and IATA. For now we will focus on North America and Europe.

Cost versus savings - user fees for Europe; will not be considered in the US.

First order effect is capacity. Will not look at efficiency improvement. Time savings is related to block time - predictability and non predictability of block time. Delay is beyond the block time. Time savings will let the airline reduce their block time if it's predictable or let them time buffer if it is not predictable. Everything outside the block time is a delay. Everything inside the block time is time savings. Capacity improvement, constraint removal at the top, monetize time savings, fuel savings, cost fee savings.

For Europe, an important output of the model is a weighted average of the capacities based on weather conditions. Revenue side - look at possible additional capacity. Rudy discussed how the scheduling capacity at Frankfurt is affected by weather. For example, during VFR the airport can accept 100 movements/hr and during IMC the airport can accept 24 movements/hr, so we use 74 movements/hr as the scheduling capacity. Rudy is interested in the declared capacity - the average of the actual capacities weighted by the different weather conditions. Number of movements/hr for scheduling purposes.

Boeing will work off-line and work with MITRE. Rudy will get IATA numbers. Rudy needs to understand the procedures for enhanced visual approaches and parallel approaches and if there is a possibility for doing this for Frankfurt, Rudy would be interested in getting involved in the analysis.

First structure of the model, data requirements, take to airlines for validation, give to MITRE to check on feasibility of data. Go through another iteration of the structure. Model needs the input parameters. Will come to this group to find out if MITRE models 10 airports, 25 airports, etc. Do we model current traffic, future traffic?

Dennis - has OR department that can help with reviewing the data, rationalizations, etc.

Telecon:

Boeing will go back and review the data that we need from MITRE. Rudy to get data from IATA. Telecon scheduled for Tuesday, April 14, 9:00 SEA, 11:00 Chicago time, 12:00 east coast time. Boeing to set up telecon.

Paris Presentation:

Will describe 4 high benefit business cases, description of each one, rationale behind them, plan for getting the work done, schedule.

Ed to put charts together and send to Claudia before April 15.

Summary of ADS-B Focus Group Operating Assumptions:

- Safety benefits will be described but will not be quantified.
- Analysis will be limited to ADS Broadcast applications only including Air-Air and Air-Ground
- Analysis will not try and determine cost/benefits for General Aviation but must consider General Aviation as part of the risk assessment.
- Analysis must not be restricted to US but must be global in nature.
- Will look at both short term and long term ADS-B applications.
- Will recognize that there are diversions and cancellations as a result of delays but we won't model these second order effects.
- All documents will be transmitted to members by e-mail as well as being posted on the C/AFT website.

Summary of Actions:

Determine if data is available on cost of delays
(Claudia, Sam, Dennis and Bob)

Continue development of simulation to evaluate Enhanced Visual Approaches
(MITRE)

Obtain information on weighted average capacity model for Frankfurt
(Rudy)

Coordinate modeling requirements with MITRE
(Boeing)

Prepare draft of Paris presentation and transmit to Claudia before April 15
(Ed Porisch)

Review simulation and modeling results and provide reality check
(Claudia, Sam, Dennis and Bob)

Set up April 14th telecon
(Ed Porisch)