

**COMMITTEE ON AVIATION ENVIRONMENTAL PROTECTION (CAEP)**

**STEERING GROUP MEETING**

**Bonn, 15 to 19 November 2004**

**Agenda Item 5: Operations – WG2**

**PROGRESS DEVELOPING ANALYTICAL TOOLS TO ADDRESS  
INTERDEPENDENCIES AMONG ENVIRONMENTAL IMPACTS**

(Presented by the CAEP Member from the United States)

**SUMMARY**

This paper discusses U.S. progress in developing a suite of software tools and databases that will allow for a more comprehensive assessment of the environmental effects of aviation. The main goal of the effort is to develop a new capability to assess the interdependencies between aviation-related noise and emissions impacts, non-stringency scenarios such as operational procedures, and the associated ability to evaluate the costs and environmental benefits of these scenarios. Evaluating interdependencies and effects of policy not related to stringency on this scale will be new for CAEP. We encourage CAEP members to make a priority of developing and sharing tools and models to assist CAEP in this effort. To this end, the U.S. will continue to present to the CAEP Working Groups and FESG papers that address how U.S. R&D efforts could contribute to CAEP's ability to complete its work items over the coming work cycles leading to CAEP/8. CAEP is invited to consider these analytical tools, models, and databases in its future work program, and to collaborate in guiding their development. CAEP is further invited to encourage member states to participate and provide input to each others research and development efforts.

**1. BACKGROUND**

1.1 The CAEP Terms of Reference direct the committee to take into account the potential interdependence of measures taken to control noise and engine emissions in its work. However, the analysis to assess the CAEP/5-Noise and CAEP/6-NO<sub>x</sub> stringency proposals have included only limited information on the interdependencies between noise and emissions and amongst various emissions.

1.2 At CAEP/6 there was renewed recognition that complex interdependencies exist amongst aircraft noise and emissions and amongst various emissions, and that to achieve effective mitigation we must take these interdependencies into account. CAEP/6 recommended and ICAO's 35th Assembly subsequently adopted three environmental goals, (A35-WP/352), to limit or reduce noise exposure, local air quality emissions, and greenhouse gas emissions. Meaningful progress on these goals would be enhanced if analytical tools and supporting databases could account for interdependencies amongst these goals and potentially optimize the environmental benefit of mitigation measures.

1.3 CAEP/6 acknowledged the need to address environmental trade-offs in future work programs (CAEP/6-WP/57). The meeting agreed that the Working Groups and FESG should follow progress on the development of new tools and metrics for addressing interdependencies. The newly constituted Working Group 2 has begun the process of identifying future CAEP modeling requirements, and has already highlighted the need for an enhanced analytical capability to address noise and emissions interdependencies.

1.4 In addition to noise and NO<sub>x</sub> stringencies, CAEP has also studied policies that do not require stringency. There are now two ICAO documents that describe various non-stringency measures that affect aviation noise and emissions. These are Document 9829 - *Guidance on the Balanced Approach to Aircraft Noise Management* and Circular 303 – *Operational Opportunities to Minimize Fuel Use and Reduce Emissions*. Working Group 2 has noted that improved analytical tools are also needed to assess these policies, including trade-offs between noise and emissions impacts, in a meaningful way.

1.5 The U.S. believes that CAEP needs to foster concerted, sustained research and development (R&D) efforts to enhance environmental analytical tools to routinely provide information on interdependencies between noise and emissions and amongst emissions. At CAEP/6, we proposed the development of a more comprehensive set of environmental analyses tools (CAEP/6-WP-49). We suggested short and longer-term actions toward moving forward in dealing with aviation environmental issues in an integrated fashion.

1.6 At CAEP/6, the U.S. also provided an informal presentation on our R&D plans to develop a suite of comprehensive, transparent aviation environmental analytical tools and databases to assess impacts and interrelationships between noise and emissions and amongst different types of emissions. These tools would be applicable to both stringency and non-stringency measures and policies. We invited CAEP members and observers to provide input on the sets of questions these tools should address to support projected CAEP needs. In the present paper, we provide an update on the progress to date of our analytical tools and databases R&D efforts.

## **2. PROGRESS AND PLANS FOR ADVANCING TOOL SET DEVELOPMENT**

2.1 The U.S. notes that various states have ongoing work to develop analytical tools, models, and databases addressing aviation environmental issues that could assist CAEP in its decision-making process. We encourage such states, as we are doing, to introduce the output of their R&D efforts into CAEP with the goal of helping CAEP understand the use of such tools and complete its work program consistently with its terms of reference.

2.2 A central building block of the new suite of software tools and databases being developed by the U.S. is the Aviation Environmental Design Tool (AEDT), which will integrate existing national, and potentially international, noise and emissions models with a new aircraft and engine analysis tool, referred to as the Environmental Design Space (EDS). To complete the suite of tools, AEDT and EDS will be integrated with an economic analysis capability, entitled the Aviation Environmental Portfolio

Management Tool (APMT). This suite of tools will enable assessments of global, regional, national, and airport-specific environmental impacts of aviation and associated economic costs and societal benefits. Specifically, the tool set will model aviation system technology changes, operational impacts of aviation noise and emissions policies, manufacturer and operator costs of noise and emission reduction, environmental and health related costs associated with noise and emission exposure, and broader societal macroeconomic effects.

2.3 In the U.S., these tools and databases are necessary for complementary applications to CAEP that assess the effectiveness of aviation R&D targeted at environmental innovations, and to track national noise and emissions abatement performance goals. Given the importance of this capability across a diverse array of stakeholders, we have sought the help of an independent scientific body, the U.S. National Academy of Sciences (NAS). The NAS assembled a group of carefully vetted, independent experts, comprising academia, environmental organizations, manufacturers, airlines, airports, and aviation environmental model developers and users. This group, named the AEDT-APMT Committee, also includes an international representative, specifically from the U.K. It seeks to provide independent and unbiased expert advice to the development process.

2.4 The AEDT-APMT committee conducted a workshop in March/April 2004 to analyze the AEDT requirements. At this workshop, the committee engaged nearly 80 experts (including manufacturers, airlines, airports, academia, environmental organizations, and the international community) in refining the AEDT process, including key drivers. The AEDT-APMT committee and a representative cross-section of experts provided further input into this work plan at a second workshop in August 2004.

he requirements for U.S. research are broader than the proposed workplan for CAEP. The suite of tools and databases being developed will have both international and domestic applications. Nevertheless, CAEP has the clear mandate for international aviation, and the requirements for CAEP will have a central influence on U.S. R&D investment decisions.

2.6 We believe it important to promote participation of CAEP members and participants in the development of various states' endeavors to develop these tools, models, and databases. Although progress can be reported at Working Group and FESG meetings, these meetings might not allow for the extensive technical interchanges attainable in specialized workshops. We believe that the CAEP work program could benefit from activities that go beyond what is possible in Working Group and FESG meetings such as participation in cooperative research and development planning workshops and joint validation/verification exercises. Therefore the U.S. will continue to invite CAEP Working Group and FESG to its national modelling and economic workshops, and will participate in similar activities sponsored by other states.

2.7 The AEDT-APMT committee is in the process of organizing additional workshops for advancing the development of APMT. To inform the workshops, the U.S. is collecting information from interested parties on the appropriate scope and applications of the tool. FESG participants and CAEP Members have been invited to provide input via a survey (<http://spacestation.mit.edu/faa>). The first APMT Workshop will be held in January/February 2005 and will focus on analyzing APMT requirements. A second workshop to review the work plan to develop APMT will be held in May 2005.

2.8 The U.S. will use the analyses needs defined by Working Group 2 and input from FESG to guide demonstrations of the capabilities of a suite of analytical tools, models, and databases that

support CAEP analyses needs. We expect to demonstrate some of these capabilities by the next Steering Group meeting.

### 3. **ACTION BY CAEP**

#### 3.1 CAEP is invited to:

- a) Note the essential role of such analytical tools, models, and databases as described in this paper and those like them for completing the CAEP work program
- b) Encourage member states to develop relevant analytical tools, models, and databases that will assist CAEP in its work program.
- c) Note the contribution of U.S. efforts to develop applicable tools and databases and its invitation to CAEP participants and members to participate in its tool development workshops.
- d) Encourage member states to participate and provide input to each others research and development efforts on analytical tools, models, and databases that support future CAEP needs.

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