

LETTER REPORT

**Workshop #2**

**FAA Aviation Environmental Design Tool (AEDT)  
and Aviation Portfolio Management Tool (APMT)**

August 24 – August 26, 2004  
Washington, DC

April 20, 2005

Mr. Carl Burleson  
Director, Office of Environment and Energy  
Federal Aviation Administration (AEE-1)  
800 Independence Avenue, SW  
Washington, DC 20591

Dear Mr. Burleson:

This report is a summary of the results of a second workshop in a series that the Federal Aviation Administration (FAA) asked the Transportation Research Board (TRB) of the National Academies to conduct to assist in the ongoing development of a new aviation environmental design tool (AEDT) and an aviation environmental portfolio management tool (APMT). AEDT is intended to provide a common, transparent, integrated capability for computing and identifying interrelationships between noise and emissions and among various emissions at the aircraft, local, regional, and global (international) levels. APMT will supplement AEDT by providing a capability to conduct related cost–benefit analyses. This input from the TRB workshop series is intended to help guide FAA when it is developing these tools.

The first workshop in the series was held from March 31 to April 2, 2004. It focused on soliciting stakeholder input for initiating the development of AEDT, and its results were transmitted to FAA in a letter report dated November 2, 2004. This second workshop was held August 24–26, 2004, and its main purposes were to

- Provide background briefings to the stakeholder community on FAA’s progress in developing AEDT,
- Seek aviation community comments and suggestions on the AEDT work plans that FAA has prepared to date, and
- Introduce and seek aviation community input on FAA’s plans to integrate economic considerations into the overall development of aviation environmental design tools.

The letter report of the first workshop presented the task statement for this project and FAA’s charge to the committee. To accommodate the task of adding a tool to conduct economic analyses that followed the first workshop, the committee membership was expanded to include economics expertise. Enclosure 1 provides the current membership of the study committee.

This letter report of the second workshop describes the workshop's organization, presents the committee's summary of workshop discussions, and provides the committee's findings and recommendations to FAA regarding the most effective future development of its design tools.

## **ORGANIZATION AND CONDUCT OF SECOND WORKSHOP**

The second AEDT workshop was held at the National Academies conference center, 500 Fifth Street, NW, Washington, D.C., beginning on August 24 and ending on August 26, 2004. The agenda for the workshop appears in Enclosure 2.

On the afternoon of August 24, the committee met mainly for the purposes of setting the final agenda details and determining administrative procedures for the conduct of the workshop. Because the workshop would entail a substantial number of presentations by FAA and its contractors on its work, the committee wanted to ensure that there would be ample opportunity for discussions, debate, and sharing of viewpoints among all parties, including those who to date were not part of the development efforts. The committee also reviewed the participant list to determine the most appropriate mix of individuals to ask to join in the breakout group discussions. Finally, the committee reviewed the information that would be presented to participants to stimulate discussion.

On August 25, a full-day plenary session of the workshop was devoted mainly to presentations by FAA and its consultants on various aspects of the AEDT work plan that had been developed to date. The following presentations were made:

- **AEDT Background and Need:** This included the schedule for AEDT development (i.e., an initial version complete by 2006 so that it can be presented to the international community at its meeting of CAEP/7 in 2007).<sup>1</sup> It also included plans to split AEDT into separate but linked local and global models and to focus on AEDT use as a tool for airport planning applications. The local AEDT would be publicly available for a wide range of users.
- **Technical Approach:** This presentation revealed that local AEDT will consist of enhanced but existing FAA models while global AEDT will consist primarily of SAGE and MAGENTA.<sup>2</sup> AEDT is also supposed to be modular and accept alternative U.S. and international models. Local AEDT and global AEDT should work together and, when fully developed, use the same source sets of data as well as the same algorithms. [These source sets of data are now generally found in SAGE and MAGENTA, and the algorithms are generally found now in Emission & Dispersion Modeling System (EDMS), Integrated Noise Model (INM), and Environmental Design Space (EDS).] The plan to eventually use the same data sets is not only to ensure modeling consistency but also to reduce the number of tools that FAA will need to operate and maintain in the future.

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<sup>1</sup> CAEP is the international Committee on Aviation Environmental Protection, which meets periodically to review problems and adopt standards.

<sup>2</sup> SAGE is a System for Assessing Aviation's Global Emissions; MAGENTA is a Model for Assessing Global Exposure from Noise of Transport Airplanes.

- **AEDT EDS Module:** In this presentation, FAA announced that it has assigned the responsibility for developing the EDS module to the National Aeronautics and Space Administration (NASA), partially because FAA intends to base initial versions of EDS on existing NASA codes that calculate such factors as noise generation, engine emissions, and life cycle costs.
- **AEDT Local Modules:** This presentation covered plans for developing the local module that will predict noise and emissions and perform trade-off analyses while being similar to existing software.
- **AEDT Global Modules:** This presentation discussed the plans for global module development, including concerns about existing data sources and the need to improve their harmonization.
- **Next Steps in AEDT Development:** This presentation discussed plans for an architecture study, the need for building early test versions, and case studies for assessing performance of various modules. The need to ensure transparency and evaluate uncertainty was also discussed.
- **AEDT Connectivity to APMT:** FAA's plans to incorporate economic considerations into the process with the development of a complementary tool (APMT) were presented next. The discussion covered an estimated time schedule for APMT and the international focus of its initial development. FAA has just begun to develop its plans for APMT and will further explore the key issues at the next workshop.
- **AEDT Budget, Milestones, and Program Management:** FAA presented its overall budget plans and its proposed management structure for the development process. Discussions focused on the adequacy of committed funding for the project, how to set priorities and meet overall goals with limited resources, and future prospects for possibly needed additional funding.

On August 26 the workshop participants divided into two breakout groups (A and B) for more detailed discussions of the major issues raised in the previous day's presentations and discussions. Common themes included questions about how to ensure adequate flexibility and transparency in the AEDT development process; balance proprietary interests with the need to provide public access to models and data; adequately train and certify users; maintain international support; manage the process efficiently and effectively; and keep the proper relationship among budget, schedule, priorities, and goals.

To guide their discussions, the breakout groups received a list of issues that reflected the above themes. Most of the day was devoted to the breakout discussions, and the two groups then reported back to a plenary session with a summary of their discussions, issues of concern, and comments regarding the adequacy of the FAA work plan. (See Enclosure 3 for a summary of the discussion items from Groups A and B.) In a final session, all workshop participants offered concluding comments and suggestions to the committee and others present. After the workshop concluded, the committee met and discussed the input from all parties. The committee prepared

its findings and recommendations for future actions, which are contained in this letter report and are based on the workshop results and the committee's evaluation of them.

## **COMMITTEE SUMMARY AND COMMENT ON WORKSHOP DISCUSSIONS**

The workshop discussions provided both (a) overall comments on the FAA plans and approach for developing AEDT and (b) specific concerns about the effects this new tool might have on the aviation community and individual stakeholders. The committee offers the following summary and comments to assist and complement the development process. The comments are divided into the six themes of most concern or interest to the participants: transparency, balancing proprietary interests with access, user training, the use and application of models, the role of NASA, and the budget and technical goals.

### **Maintaining Flexibility and Transparency**

Transparency is essential for both the global model and the local model to have credibility. FAA has stated that development of the global model is driven by the needs of the international community. Transparency and credibility are critical for local models because those models will need to fulfill legal requirements, such as impact assessment. In addition, transparency and flexibility of local models can lower FAA maintenance costs because commercial users will update data files themselves. Existing local models are open source and widely distributed. However, largely because of the immense size of the existing global models, they (SAGE and MAGENTA) are operated only at Volpe National Laboratories and Wyle Laboratories, respectively. As it develops AEDT, FAA will need to include a plan to balance the needs for transparency, continued availability of the model to today's user base, the ability to manage the models, and development of protocols to manage potential abuses of the models.

One example of the problem of model transparency is FAA's plan to adopt certain NASA models that are protected and difficult to distribute because they contain proprietary data. The committee believes that FAA should clearly determine how it can allow wide distribution of a consolidated model that may contain such NASA components. The transparency needed to convince international partners and build trust in the outcome of the tools may be difficult to attain if the models provided are entirely closed. The committee also believes that an aggressive and proactive plan to work with critical stakeholders—especially those who might be most skeptical of the model—could address this issue. Early and extensive sharing of basic model physics, traceability of data, and validation may overcome, to some extent, areas of incomplete transparency.

### **Balancing Proprietary Interests with Public Access Needs**

Considerable discussion centered on the problem of effectively balancing proprietary interests with the need for public access to the FAA-developed models. For example, monetizing benefits to operators and manufacturers may require disclosure of proprietary data. The committee concluded that major questions remain unanswered in this area, such as how to accomplish the following goals: to model operator impacts without using proprietary data, to protect any

proprietary data used, to publish results that can be accepted by a wide range of stakeholders without compromising business-sensitive information, and to collect and update data. The committee believes that FAA will need to attend to this issue and evaluate possible solutions in concert with affected stakeholders.

### **Training and Qualification of Users**

Related to the issue of access is defining the plan FAA has for the training and qualification of users of AEDT. These are concerns because EDS and global noise and emissions models are much more complex than in the past, and this complexity is exacerbated by the planned unification of global and local models. For example, to date user training has been self-policing, but when global and local models are united algorithmically and in source data, any local study will reflect on the global model's accuracy. Thus, the committee is concerned about whether users of local models will be properly trained so that they can accurately interpret the output. The committee believes that widespread accessibility of existing models is an important goal but that it must be balanced with requirements for adequate training. It will be important for FAA to consider the development of protocols for model use early in the schedule to help manage the potential for model abuse or misuse.

### **Application and Use of Models**

Another concern of some workshop participants was the use of these models to determine whether aircraft had met requirements of past regulations. While existing funding seems to preclude such efforts, availability of transparent and accessible tools may mean that stakeholders themselves will address these questions in the future and then more actively enter the global discussion on stringency regulations.

Ground-level emissions from nonairport sources (related activities in the vicinity of airports) and general aviation activity are not well represented in AEDT. The data need to be developed even though some business jets are presently included in noise analyses. Because evidence points to higher-altitude emissions having most impact per ton for greenhouse emissions, general aviation has been relatively ignored. However, not even the first-order impacts of general aviation CO<sub>2</sub> and water vapor emissions are known, and determining those should be on the research agenda.

### **Relationship Between FAA and NASA Roles**

Discussions highlighted the fact that NASA's role in AEDT development requires clarification. To create models of aircraft designs, FAA is allocating resources to marry existing NASA models and extend them. Although not all NASA models can be distributed, this work should result in a product that is distributable as described in the earlier section on maintaining flexibility and transparency. Consolidation of NASA models should take this distribution requirement into consideration. The committee believes that the envisioned end product should allow users to model new aircraft, which is a key requirement for the EDS model slated to accompany local and global models.

## **Relationship Between Budget Allocations and Technical Goals**

On the basis of FAA presentations and workshop participant comments, the committee has become concerned that the AEDT development plans and technical goals may not be achievable under the budget outlined by FAA. Because the budget may not be adequate, there is a need to set consensus-based priorities of FAA goals for accomplishing AEDT and APMT. An already-stated goal of FAA is not to invent new models but to spend time and dollars knitting together existing ones. Some stakeholders expressed their belief that it is particularly important for FAA to remain focused on this resolution and not be led down tangential development paths by concerns about developing a new functionality or new code.

At the same time, however, some stakeholders expressed a need for additional capabilities from existing models (especially in the air quality models) to meet evolving regulatory requirements and the need to ensure that existing models are validated before being put into the context of AEDT. For example, concerns were identified about the ability to model reverse-thrust emissions and noise, particulate matter emissions, and hydrocarbons in AEDT.

## **CONCLUSIONS AND RECOMMENDATIONS**

The committee recommends that FAA consider the four initiatives detailed below to improve the development process for AEDT and APMT. It believes that FAA has made considerable progress to date in its efforts to provide these new models and that continued attention to stakeholder needs and technical excellence will maximize the chances of ultimate success.

### **1. Technical Initiatives Involving AEDT Design and the EDS Component**

The committee concludes that NASA's role in the AEDT development plan needs clarification. To create an aircraft design space, FAA is allocating resources to marry existing NASA models and extend them. Although not all NASA models can be distributed, this work should result in a product that is distributable (see the earlier section on maintaining flexibility and transparency). Consolidation of the NASA models should take this distribution requirement into consideration. In addition, the envisioned end product should allow users to model new aircraft, which is a key requirement for the EDS model slated to accompany local and global models. Furthermore, although the model that NASA will design feels similar to those that resulted from previous research, the requirements set for the final product are unique. While certain individual components have already been tested independently, the research should examine new vehicles under EDS so that the final tool will surpass and leverage existing capabilities. Furthermore, the committee understands the possibility of new, still unaddressed research questions that can be answered only by NASA. For example, how do emissions at ground level compare with emissions at altitude? What is general aviation's contribution to the emission of CO<sub>2</sub> and water? These questions may or may not be part of the EDS development plan.

Therefore, the committee recommends that FAA and NASA clearly agree on and identify the resources that FAA is dedicating to EDS development at NASA and separate them from other NASA research. The committee also recommends that FAA include in its work plan a clear description of NASA's assigned tasks, goals, and schedule within the AEDT development.

In addition to questions about NASA's role, the committee also concludes that uncertainty exists regarding the role of the EDS model within AEDT. Therefore, the committee recommends that FAA clarify the different roles of EDS outputs versus databases of existing aircraft to help stakeholders understand the uses of the model in different contexts. Furthermore, FAA should explain the appropriateness of its validation plan and demonstrate how using two aircraft per year would simulate a fleet of aircraft.

## **2. Priorities, Schedule, and Budget**

The committee recommends that FAA develop a more rigorous process for determining the required budget for developing AEDT measured against clearly stated priorities within the development process. The committee is concerned that current budget allocations will not cover the plans outlined. There is also a need to establish consensus-based priorities for FAA's goals in accomplishing AEDT and APMT. The committee raises these concerns given the present allocation of budget dollars toward goals.

The committee concludes that the current FAA effort to develop AEDT will require substantial resources because it is a very complex task with large uncertainties. For example, harmonizing the global models (SAGE and MAGENTA) will require rewriting of at least one of the models (a very costly endeavor) because each is essentially monolithic. This harmonization effort could use most of the available resources, and, therefore, its priority within the total AEDT must be examined continually. In addition, budget estimates presented by FAA indicate that the total costs of maintaining all models will begin to decrease by the end of CY 2008, when models begin to operate on common data sources. Whether these cost savings will be achieved must be continually evaluated.

## **3. Project Management (Including Outreach and Review Process)**

The committee recommends that FAA establish a stronger project management program, including one designated full-time project manager to centralize communications and accountability. Similarly, FAA should work with NASA and other important contributors to prepare written agreements with stated obligations to ensure clear expectations and accountability.

The committee concludes that the current work plan lacks both (a) explicit budgeting of development and harmonization work into subtasks and (b) any indications of the people and the organizations doing the work. While the current documents are informative, the organizations performing the work are not explicitly connected to budgeted study priorities. In addition, a more detailed plan of work over the next year is essential for better evaluation of FAA's process and approach.

The committee also recommends that FAA indicate how it plans to coordinate with international and national nongovernmental organization (NGO) stakeholders. While TRB is one review venue, these NGO stakeholder groups have not been present at the past two TRB review meetings. FAA should initiate interaction with international stakeholders, international and domestic governmental entities, NGOs and corporations, and U.S. air carriers. For example, state government entities such as air quality agencies are also important stakeholders. FAA should plan to reach out to international partners at the earliest possible date. Similarly, FAA should reach out to stakeholders, such as NGOs, that are currently not well represented but may prove critical to ultimate acceptance of AEDT. This coordination should consider some of the questions about transparency and validation discussed above.

The TRB workshop participants consisted primarily of experts who are already involved in building models for FAA and NASA. The committee recommends that future workshops include, especially during the APMT discussions, more participants from airlines and manufacturers that have an economic stake in the outcome. At the same time, however, it is important to reach out to other stakeholders (especially international governments and NGOs) to achieve as much education, analysis, and input as possible, as early as possible, and to maximize the likelihood of general acceptance of the tool.

The committee also recommends that FAA develop a plan for managing the appropriate use of AEDT (especially EDS) to reduce the potential for its abuse. This management should include training and modeling protocols that would govern accepted use of the model outputs. The committee is concerned about unduly limiting access to the model. However, the committee wants to ensure that model outputs are reasonably transparent so that unreasonable assumptions and inputs into the model that generate suspect and potentially abusive results (e.g., physically impossible aircraft engine configurations in EDS or inappropriate operational or weather assumptions for local noise and emissions modules) can be readily identified. Early consideration of protocols for the use of the model and its data would help identify whether supporting measures should be built into the model from the beginning rather than clumsily added after the fact.

#### **4. Validation and Final Output of Model**

AEDT outputs must be suitable to provide input to anticipated regulatory requirements, policy needs, and APMT. APMT input issues cannot be examined until APMT is examined and the APMT outputs are defined. The committee recommends that FAA identify a concept of the APMT outputs that are needed by airlines and manufacturers. This concept should be based on an evaluation of available models to determine which ones provide the needed results. FAA should also get input from those industry experts who own or license the models.

Sincerely,

Wesley L. Harris

Chair, Committee for Developing Aviation Environmental Design Tools (AEDT) and Aviation Environmental Portfolio Management Tools (APMT)—A Workshop Series

Enclosures

1. Committee Roster
2. Workshop Agenda
3. Summary of Breakout Group Discussion Items
4. List of Workshop Participants
5. Table of Acronyms

## TRANSPORTATION RESEARCH BOARD Committee Roster

### Committee for Developing Aviation Environmental Design Tools (AEDT) and Aviation Environmental Portfolio Management Tools (APMT)—A Workshop Series

(Membership and member affiliations are as of August 24, 2004)

Chair	Dr. Wesley L. Harris Charles Stark Draper Professor and Head Department of Aeronautics and Astronautics Massachusetts Institute of Technology  Dr. Meyer J. Benzakein General Manager, Advanced Engineering General Electric Aircraft Engines  Mr. Lawrence W. Craig Chief Engineer, Noise & Emissions The Boeing Company  Dr. Gerard M. Faeth (Deceased, January 2005) Arthur B. Modine Professor of Aerospace Engineering University of Michigan  Ms. Angela Gittens Director Miami International Airport  Mr. Richard S. Golaszewski Executive Vice President Gellman Research Associates, Inc.  Mr. Ian Jopson Project Manager, Noise Effects Civil Aviation Authority, United Kingdom	Dr. Dimitri N. Mavris Professor and Director Aerospace Systems Design Laboratory School of Aerospace Engineering Georgia Institute of Technology  Mr. John E. Putnam, JD Partner Kaplan Kirsch & Rockwell, LLP  Mr. Jacob Schmidt Policy Analyst Center for Clean Air Policy  Ms. Virginia Stouffer Research Fellow LMI Government Consulting  Mr. Ray Valeika Senior Vice President, Technical Operations Delta Air Lines, Inc.  Ms. Mary Lee Vigilante President Synergy Consultants, Inc.
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**AGENDA: AVIATION ENVIRONMENTAL DESIGN TOOL (AEDT) AND  
AVIATION PORTFOLIO MANAGEMENT TOOL (APMT) WORKSHOP No. 2  
August 24 – August 26, 2004**

<i>Day</i>	<i>Time</i>	<i>Event</i>	<i>Room</i>	<i>Group</i>	<i>Moderator/ Speaker</i>	<i>Topic/Comments</i>
<b>Day 1: Tuesday, August 24</b>	<b>12:30–1:30</b>	<i>Committee Administrative Session</i>	110	TRB	W. Harris/ J. Breen	<b>CLOSED SESSION</b>
	<b>1:30–2:00</b>	Review AEDT Workshop #2 Agenda	“	ALL	W. Harris/ L. Maurice	Workshop #2 preparation
	<b>2:00–2:30</b>	Discuss Charter for Expanded AEDT Committee	“	ALL	W. Harris/ L. Maurice	Discuss APMT work
	<i>2:30–2:45</i>	<i>Break</i>				
	<b>2:45–4:30</b>	AEDT Background Briefings for New Committee Members	“	ALL	L. Maurice/ T. Connor/ C. Holsclaw	Bring new committee members up to speed
	<b>4:30</b>	<b>Meeting Adjourned</b>				
<b>Day 2: Wednesday, August 25</b>	<i>7:30–8:00 am</i>	<i>Continental Breakfast</i>	<i>Pre</i>		—	
	<b>8:00 am</b>	Welcome/Administrative Items	100	ALL	J. Breen	Administrative remarks
	<b>8:15–8:30</b>	Welcome	“	“	W. Harris	Workshop overview
	<b>8:30–9:00</b>	Overview of Briefings	“	“	L. Maurice	AEDT work plan presentations
	<b>9:00–9:30</b>	AEDT Background and Need	“	“	J. Draper	
	<i>9:30–9:45</i>	<i>Break</i>				
	<b>9:45–10:45</b>	AEDT Technical Approach	100	ALL	G. Fleming	AEDT work plan presentations
	<b>10:45–11:30</b>	AEDT EDS Module	“	“	P. Parikh	
	<i>11:30–12:30</i>	<i>Lunch</i>	<i>Atrium</i>			<i>3rd Floor Cafeteria</i>
	<b>12:30–1:00</b>	AEDT Local Modules	100	“	E. Dinges	AEDT work plan presentations
	<b>1:00–1:30</b>	AEDT Global Modules	“	“	K. Plotkin	
	<b>1:30–2:00</b>	AEDT Development Next Steps	“	“	G. Fleming	
	<i>2:00–2:15</i>	<i>Break</i>				
	<b>2:15–3:00</b>	AEDT Connectivity to APMT	“	“	M. Locke	AEDT work plan presentations
	<b>3:00–4:15</b>	AEDT Budget, Milestones, & Program Management	“	“	J. Gulding	
	<b>4:15–4:45</b>	Summary of Work Plan Responsiveness to Workshop #1	“	“	L. Maurice	Respond to Workshop #1 recommendations
	<b>4:45–5:00</b>	Concluding Remarks	“		C. Burleson	Put AEDT/APMT in context of agency mission
	<b>5:00</b>	<b>Participants Adjourn</b>				
<b>5:00–5:15</b>	Administrative/Planning	100/ TBD	FAA/T RB	W. Harris L. Maurice		
<b>5:15–5:30</b>	<i>Committee Meeting</i>	100	TRB	Committee	<b>CLOSED SESSION</b>	

<b>Day</b>	<b>Time</b>	<b>Event</b>	<b>Room</b>	<b>Group</b>	<b>Moderator/ Speaker</b>	<b>Topic/Comments</b>
<b>Day 3 : Thursday, August 26</b>	7:30–8:00AM	<i>Continental Breakfast</i>	<i>Pre</i>	<i>ALL</i>	—	
	<b>7:30–8:00</b>	TRB/FAA Admin/Logistics Session	101	TRB/FAA	W. Harris L. Maurice	AEDT committee and FAA sponsors
	<b>8:00–8:30</b>	Recap of Previous Days and Charge to Breakout Groups	“	ALL	W. Harris & AEDT Committee	Agree on process to review and comment on work plan
	<b>8:30–11:30</b>	Groups Review AEDT Work Plan	100	A	J. Putnam/ D. Mavris	Groups A and B review work plan <i>(Individual breaks as needed)</i>
			101	B	I. Jopson/ J. Schmidt	
	11:30–12:30	<i>Lunch</i>	<i>Atrium</i>	<i>ALL</i>		<i>3rd Floor Cafeteria</i>
	<b>12:30–1:00</b>	All Groups Continue Morning Assignment in Breakout Rooms	100	A	J. Putnam/ D. Mavris	Breakout groups prepare to present feedback.
			101	B	I. Jopson/ J. Schmidt	
	<b>1:00–2:00</b>	Feedback from Breakout Groups	100	ALL	W. Harris	
			A B	10-0	Group A Group B	Spokesperson for each group summarizes activities
	2:00–2:30	<i>Break</i>	<i>Pre</i>	<i>ALL</i>		<i>W. Harris Prepares Summary</i>
	<b>2:30–3:00</b>	Summary and Discussion of Feedback	100	ALL	W. Harris & AEDT Committee	Summarize and integrate all inputs
	<b>3:00</b>	<b>Participants Adjourn</b>				
<b>3:00–4:00</b>	FAA/TRB Administrative	101	FAA/ TRB	W. Harris & AEDT Committee	Plan APMT Workshop	
<b>4:00</b>	Adjourn					

## **AVIATION ENVIRONMENTAL DESIGN TOOL (AEDT) AND AVIATION PORTFOLIO MANAGEMENT TOOL (APMT) WORKSHOP No. 2**

### **List of Discussion Points from Breakout Groups A and B August 26, 2004**

The following points resulted from the two breakout group discussions on the third and final day of the workshop. They are summarized here, along with detailed comments and concerns about the FAA work plan for development of AEDT as presented to workshop participants at the plenary sessions.

#### **GROUP A COMMENTS**

##### **CAEP Needs Identified by FAA**

At the workshop, the FAA described the need to capture and model NO<sub>x</sub> emissions and particulate matter, so that the FAA would be ready for discussions with CAEP on potential NO<sub>x</sub> stringency measures (i.e., the phaseout of most NO<sub>x</sub>-producing airplanes). In addition, FAA said that CAEP has raised the possibility of future noise-stringency measures, and FAA needs to be able to understand the trade-offs, overlaps, and costs between pollutant stringencies and noise stringencies. Therefore, if the AEDT model captures and allows what-if modeling of these variables, it must allow modeling of global technology changes and be acceptable to international stakeholders.

##### **Setting Priorities for Needs in Work Plan**

- Trade-offs between noise and emissions will be important to incorporate into the AEDT global model. It must be demonstrated that a trade-off space exists in which decreasing the value of one of those two variables increases the other. Being able to show this relationship is useful in educating all stakeholders.
- Few details seemed to be provided at the workshop on the cost component of the global model.
- The technology questions regarding the EDS component must be clarified. In addition, it was unclear to many why an investment is being made in a technology change model when plans call for the ability to model future aircraft.
- The capabilities for CAEP need to be balanced, and more information must be provided on the CAEP modeling questions to ensure that AEDT/APMT will provide answers.

##### **Strengths and Weaknesses of Approach**

- A need exists for a discussion on priorities within the work plan approach. Among important questions about the approach are these: What are the modeling priorities?

Should there be a reasoned modeling discussion with the CAEP? Should the financial impact of CAEP-proposed legislation be anticipated? Should AEDT provide the modeling arm for CAEP?

- Questions arose about whether the proposed budget was realistic and defensible because the budget is short and the list of needs is long. In addition, some issues seem to be missing from the budget, such as harmonization, economic modeling, single data source, modeling new aircraft, and maintaining existing models.
- The existing cost and budget information is a rough draft and needs more work. For example, all of the following require additional consideration: scheduling resources, deciding who is maintaining the existing models or working on integration, and determining who will integrate the local models. FAA needs to decide the cost of each effort, the sources of the economic models, the people who will integrate the models, and the cost of that integration.
- The issue arose of balance between legacy models and the planned new capability. It is tempting to continue pushing the integration of the economic models into the future; however, U.S. stakeholders need the economic modeling portion early, so that they may predict the economic consequences of some CAEP-supported initiatives.
- The next meeting will require a more detailed plan that includes consideration of cost risk for areas outside of FAA's control, such as NASA's budget. The portion now allocated to NASA—EDS—is key to the future modeling capability, and yet NASA is not scheduled to produce it until after 3 years of work. Something more certain is necessary, like a proven model and a formal relationship between FAA and NASA to ensure meeting expectations and assigning accountability, because NASA's existing plan of action lacks detail.

### **Management Plan**

- A written agreement is required for formalizing the relationship between FAA and NASA, including definition of such issues as cost-sharing, designation of a single point of contact, and specification of a level of staff effort.
- The project will need strong (effective, efficient, and accountable) project management, and AEDT probably should be the project manager's single responsibility.

### **Validation Plan**

- A question arose about whether assessment methods should be considered early so that they can guide development and validation. The value of continuous and simultaneous verification and validation was given as a reason for considering this question.
- Pursuit of all efforts as economically as possible is critical to ultimate success and acceptance of the model. Money should not be spent developing new models when

existing ones are operational and can be loosely coupled with the use of systems tools. For example, using already validated and proven models reduces revalidation costs.

## **Schedule**

- The detailed schedule to develop AEDT for the next year should be reviewed. Existing schedules are delineated in 1-year or 2-year increments. And there is a need to see a deeper level of thinking about who will do what and when.
- It is important to show how expert advice will become integrated into the model during schedule preparation.
- Another expressed need is for an integrated schedule to evaluate with the budget. For example, FAA should determine which contractor, university, or industry partner is going to perform what work; how long it will take; and what level of effort is associated with that work. Year-level schedules should be supported with this type of detail to avoid missing a key start date.

## **Other Issues**

- The issue of the possible misuse of the model should be addressed, a comment that came also from the previous meeting.
- FAA should consider both the need for protocols for model use and how the model can reinforce the protocols.
- The work plan should address the access and transparency plan.

## **GROUP B COMMENTS**

### **Role of EDS in Overall Plan**

The EDS role and plan seem unclear. For example, it is accepted that there is value in noise–power–distance curves and emissions indices produced by EDS, but there is uncertainty about when they will be available. Another concern is that updating two aircraft annually for validation of the EDS model is insufficient. Question also arose on how the EDS plan will accommodate international harmonization and how EDS will address future aircraft scenarios.

### **Complexity of AEDT Local Plan**

The AEDT local plan seems overly complex and the development period too long. A simpler harmonization of INM and EDMS may be an attractive short-term goal.

## Budget

- The proposed budget does not seem consistent with the desired work plan. Ways to close the gap between the budget and the cost of desired work need to be examined.
- Contingency plans should be prepared to reflect various possible funding levels.
- More detail is needed to adequately judge the reasonableness of the budget plan.

## Management Plan

- The plan needs a clear statement of priorities, drafted by the management team. These priorities should link to the budget and provide a means of making trade-offs between priorities.
- The management plan must address the validation and credibility-building process. For example, the plan could cover (a) the cross-checking process between data sources and models and (b) standards for supporting technical documentation of methods and underlying science.
- The work plan review process needs improvement. For example, it should clarify the difference between the functions of committees and of design review groups. A need also exists to make presentations more consistent, allow adequate review time, and identify research questions and details of the functional requirements of each model.
- Some confusion is apparent on the content and methods of analysis associated with APMT. Among areas of uncertainty are whether documentation is available on content and how the timelines were developed. The fact that program timelines extend beyond 2010 seems to indicate that overall program goals are not sufficiently focused.

## AVIATION ENVIRONMENTAL DESIGN TOOL (AEDT) AND AVIATION PORTFOLIO MANAGEMENT TOOL (APMT) WORKSHOP No. 2

*Sponsored by*  
TRANSPORTATION RESEARCH BOARD and  
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**AVIATION ENVIRONMENTAL DESIGN TOOL (AEDT) AND  
AVIATION PORTFOLIO MANAGEMENT TOOL (APMT) WORKSHOP No. 2**

**Table of Acronyms**

AEDC – Aviation Environmental Design Tool

APMT – Aviation Portfolio Management Tool

CAEP – Committee on Aviation Environmental Protection

EDMS – Emission & Dispersion Modeling System

EDS – Environmental Design Space

FAA – Federal Aviation Administration

INM – Integrated Noise Model

MAGENTA – Model for Assessing Global Exposure from Noise of Transport Airplanes

NASA – National Aeronautics and Space Administration

NGO – Nongovernmental Organization

SAGE – System for Assessing (Aviation’s) Global Emissions

TRB – Transportation Research Board