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**NASA HSRP Emissions Scenarios Committee Meeting
June 7, 1993**

**Donald J. Wuebbles
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August 12, 1993

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NASA HSRP Emissions Scenarios Committee Meeting*
June 7, 1993
Donald J. Wuebbles

Attendees: Don Wuebbles, Don Maiden, Steve Baughcum, John Gerstle, Alan Mortlock, Munir Metwally, Malcolm Ko, Bob Seals, Felix Torres, Bob Oliver

Guests: Roger Gardner, Upali Wickrama, Ulrich Schumann, Paul Kang, Chris Hume, Harvey Lilenfeld, Anu Vedantham

Discussion at the Emissions Scenarios Committee meeting on June 7, 1993 primarily related to determining the areas for further work before the 1995 assessment, with special focus on the plans for FY94. We also examined scenarios databases needed for the new subsonics program and made specific recommendations.

HSRP PRIMARY AREAS OF FOCUS FOR FY94

- Analysis of seasonal variations in subsonic and evaluation of importance in HSCTs. (Use models to see if it will make any difference for HSCTs).
- Parametric studies to determine importance of temperature and winds. Use single emission analysis (looking at limited number of flights). Although including full 3-D climatology may be expensive to include in emissions analyses, it may be important and parametric studies will help evaluate whether the climatology for temperatures and winds should be included.
- Evaluate how much of emissions occur within the polar vortex.
- Reexamine assumptions made in determining military emissions.
- Examine how using "real" airline network would affect the HSCT scenarios.
- Suggest that modelers perform sensitivity studies on fleet size and time-dependent fleet growth.

RECOMMENDATIONS FOR SUBSONIC PROGRAM

Baseline scenario: 1992

We suggest that 1992 be used as the base year (away from problems of 1990 and 1991, but closer than 1989 to time of program). One caveat: may not have ICAO and DOE data on global fuel burn at time that scenario database is completed. Include seasonality effects.

Mid-line future scenario: 2003

In coordination with ANCAT, we recommend 2003, instead of 2000, because this is after Stage II phaseout.

Historical scenario: ?

We will evaluate which year will be best based on availability of emissions (EI) data for appropriate engines. Aiming at 1980 or before.

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Future scenario: 2015

After ICAO review, we will need to consider need for reanalysis of the 2015 subsonic. We may need to account for changing international regulations.

OTHER QUESTIONS AND ISSUES

There remains the question of whether we need to revisit the basic assumptions (e.g. fixed passenger demand) that we used in developing the HSCT scenarios?

Should we try to account better for real flight control effects on flight altitude and pathway.

Also need to consider whether soot and other particle emissions need to be considered in future analyses.

Other issues were discussed (such as supersonic corridors) but it was decided that these should be addressed later (FY96?).

COORDINATION WITH OTHER PROGRAMS

We are increasing the coordination with the European programs, such as ANCAT, and with ICAO. We will be invited to the ANCAT meeting to be held in September. We have also asked Roger Gardner to become a member of our committee. We should consider Upali Wickrama of ICAO as well.

QUALITY CONTROL/VALIDATION PLAN

Enclosed is a report prepared by Bob Seals relating to the quality checks being planned by NASA Langley for the emissions databases being submitted to them.

Aircraft Emission Data Set Quality Control/Validation Plan
Robert M. Seals, Jr.
NASA Langley

1. PURPOSE AND SCOPE

The primary purpose of this plan is to establish a process at LaRC to ensure data integrity in the process of assembling aircraft emission scenario data sets from component data developed and provided by various sources. A component data set is one for a particular aircraft use (i.e. scheduled airline). A scenario data set is an ensemble set for a particular time (i.e. 2015 subsonic and HSCT). A secondary purpose is to help identify possible discrepancies or inconsistencies in the component data sets developed elsewhere or in the scenario data sets assembled at LaRC.

This plan covers activities at LaRC involved in assembling aircraft emission scenario data sets and by the component data set producers in supplying information to support evaluation of the component data sets. It does not cover work by the data producers to validate their work in developing the component data sets or to establish the fundamental soundness of the component data sets.

2. APPROACH

The first element of the plan is to have the data producers deliver a common set of information along with each component data set. In addition to the data sets themselves, this common information would include

- a complete description of format and units,
- global values for fuel burn and for emission and emission index for each quantity, -table of emission index (summed over latitude and longitude) versus altitude, on a 1 km spacing, for each quantity.

The second element is to establish a standard procedure for assembling component data sets into 3-D (longitude-latitude-altitude) and 2-D (latitude-altitude) emission scenario data sets. This procedure involves three principal steps which are summarized in the following sections.

2.1. Component data set evaluation

This step provides checks of the component data sets to ensure that they reside at LaRC in a form quantitatively the same as developed by the producer and that they are geographical reasonable. Specific activities for each component data set include

- performing checks for correct units and format consistency;
- calculating global values for fuel burn and for emission and emission index of each quantity and comparing with values supplied by the data producer;
- calculating emission index summed over longitude and latitude for each quantity and comparing to values supplied by the data producer;
- calculating fuel burn summed over altitude, plotting on a latitude-longitude grid, and checking for reasonable geographical distribution.

2.2. 3-D emission scenario data set assembly and evaluation

This step covers assembly of 3-D emission scenario data sets from the individual component data sets. The process covers checks to ensure data integrity along with reasonableness evaluations and feedback to the data producers. Specific activities for each scenario include

- summing appropriate component data sets;
- calculating global values for fuel burn and for emission and emission index of each quantity, comparing to sums of values from the component data sets, and providing the values to the data producers;
- calculating fuel burn and emission and emission index for each quantity (summed over longitude and latitude), comparing with component data set values for consistency, and providing the values to the data producers;
- summing each quantity (fuel burn, emissions) over altitude, plotting on a latitude-longitude grid to check for reasonable geographical distributions, comparing with component data set plots for consistency, and providing plots to the data producers;
- summing each quantity (fuel burn, emissions) over longitude, plotting on a latitude-altitude grid to check for reasonable vertical distributions, and providing plots to the data producers.

This step covers assembly of 2-D latitude-altitude scenario data sets from the corresponding 3-D scenario data sets. The process primarily involves checks to ensure data integrity and consistency with the 3-D data sets. Specific activities for each scenario include

- summing the 3-D scenario data set over longitude;
- calculating global values for fuel burn and for emission and emission index of each quantity and comparing to values for the corresponding 3-D data set;
- calculating emission index summed over longitude and latitude for each quantity and comparing with corresponding 3-D data set values for consistency;
- plotting each quantity (fuel burn, emissions) on a latitude-altitude grid and comparing to the 3-D scenario plots for consistency.

3. DOCUMENTATION

Documentation of these emission data sets and their development is provided in Chapter 3 of the HSRP Third Program Report and will be available electronically from LaRC. In addition, a summary set of material documenting the process described in the previous sections will be maintained at LaRC, in both hard-copy and electronic forms. The available information will include

- tables of global values for fuel burn, emissions, and emission indices for all component data sets and for all emission scenario data sets;

- table of fuel burn, emissions, and emissions indices (summed over longitude and latitude) versus altitude for each emission scenario data set;
- plots of fuel burn and emissions, summed over altitude, on a latitude-longitude grid for each emission scenario data set; and
- plots of fuel burn and emissions, summed over longitude, on a latitude-altitude grid for each emission scenario data set.

All of the documentation will be available electronically via ftp transfer over the Internet. Text documentation and plots will be available as PostScript files while the tables will be available as ASCII files.

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