



U.S. Department of
Federal Aviation Administration

Aeromedical Research Resume

Research Project Initiative Subtask for FY01

1. Title: Characterization of Cabin Environmental Factors with Longer Term Health Implications: Radiation Exposure; Cabin Air Quality (FAA-NIOSH Project)	2. Sponsoring Organization/Focal Point: AAM-1: Jon L. Jordan, M.D.	3. Originator Name, Organization James E. Whinnery Ph.D., M.D. AAM-600 Civil Aeromedical Institute 405-954-4808
		4. Origination Date: August 2000 Start Date: October 1, 2000
5. Parent RPI Number: N/A	6. Subtask Number: AM-A-01-PHY-305	7. Completion Date: September 30, 2003
8. Parent MNS: Aeromedical Research (159)	9. RPD Manager Name, Organization, Phone: James E. Whinnery Ph.D., M.D. AAM-600, FAA Civil Aeromedical Institute (405) 954-4808	
10. Research Objective(s): 1. Identify and provide estimates of flight attendant reproductive health risks and status from exposure to ionizing and nonionizing radiation in the aviation environment. 2. Assess factors that significantly affect flight crew and passenger health from historical reviews, field monitoring studies, and research that have been identified by other agencies, organizations, and institutions. 3. Evaluate factors that significantly influence disease transmission, symptoms, and both short- and long-term health effects that are related to commercial aircraft cabin environmental quality, and recommend requirements that are essential to health and safety in commercial aircraft.		
11. Technical Summary: Data derived from this research is responsive to the FAA's congressional mandates to evaluate cabin environmental conditions and to establish a research program, including research conducted by the National Institute for Occupational Safety and Health (NIOSH) under the Centers for Disease Control and Prevention. Research has also been conducted and computer programs developed/improved to estimate the amount of galactic and solar cosmic radiation received during air travel and the health risks to aircrews and to their offspring from such radiation exposure. In addition, other potential radiation health hazards in the aviation environment, such as RF/microwave radiation, are being evaluated by NIOSH. This collaborative research with NIOSH provides indirect approaches to the understanding of air cabin disease transmission, symptoms, and health effects, which may result from changes in cabin air quality or other factors. Direct epidemiological studies of disease transmission in the air cabin environment are not feasible with currently available technology. The results of these studies and additional research will provide sufficient information to evaluate current regulations, and to generate recommendations and effective interventions.		

12. Resources Requirements:	<u>FY01</u>	<u>FY02</u>	<u>FY03</u>		
FAA Staff Years	5	5	5		
<p>13. Description of Work:</p> <p>(1) Brief Background A 1993 FAA and NIOSH Interagency Agreement (IA) permitted the conduct of research to evaluate the risks to flight attendants' reproductive health. A FAA computer program has been developed and improved for use in this study to estimate the amount of galactic and solar cosmic radiation. The work on ionizing and nonionizing radiation has a 36-year FAA corporate history, and is related to providing the regulatory arm of the FAA with material necessary to develop advisories and/or regulations that will ensure a safe environment for the passenger and worker in the civil aviation setting.</p> <p>Additional studies have been identified and incorporated in amendments to the IA to serve as a comprehensive research program of exposure characterization and evaluation of cosmic radiation, aircraft cabin environmental air quality, and other physical factors.</p> <p>In the more recent development, a 1997 IA between the FAA and NIOSH was signed in response to the Congressional mandate for the FAA to examine factors affecting cabin air quality, and to establish a research program in this area.</p> <p>(2) Statement of Work This project has four major components:</p> <p>a. Cosmic radiation hazards can be predicted with sufficient accuracy to preclude relevant concerns for occupants of current aircraft and future high-speed civil transports. A solar flare advisory system can be defined that permits timely and appropriate response by users of the civil aviation system.</p> <p>b. The relationship between flight activity and respiratory symptomology in the context of complete flight history data, controlling for lifestyle factors, will be analyzed. The questionnaire for the Reproductive History contains a panel of respiratory symptom questions excerpted from national surveys including the National Health Interview Survey (NHIS) conducted by NIOSH. These questions address respiratory infections and noninfectious symptoms for current and last-year time periods. In addition to predominantly non-flying comparison group of teachers, a second large comparison population is available from the surveys' databases (e.g., NHIS).</p> <p>c. Air movements in commercial aircraft cabins will be studied to determine factors that may affect the generation, dispersal, and removal of aerosols in the cabin. Potential factors include ventilation effectiveness, airflow patterns, the number and size distribution of particles, relative humidity, and other characteristics of cabin environments. Primary means to determine factors will be through a computational fluid dynamics model that shows cabin airflow movement and the effects of other parameters, such as coughing and sneezing, in one type of airplane.</p> <p>d. Results of the studies that were conducted under the IA will be incorporated with additional research and will be used to assess the possibility of airborne disease transmission and evaluate other factors on commercial aircraft that affect the health and safety of passengers and crew. The results also will be used to develop recommendations for regulations and advisory documents relative to aircraft cabin environment requirements.</p>					

14. Intended End Products / Deliverables:

Anticipated products from the first component will include reports that describe the radiation environment at air carrier flight altitudes and provide information on associated health risks. Computer software will also be developed to estimates the amount of galactic and solar cosmic radiation received on individual flights.

A computational model that predicts bioaerosol flow movement in one type of aircraft and control strategies that minimize the possibility of disease transmission will be developed. The potential respiratory health risks associated with work as a flight attendant and potential exposures to passengers will be determined and reported and then published in peer-reviewed scientific literature.

The third FAA-NIOSH component of the research will also provide an independent assessment of commercial aircraft cabin environmental parameters, as currently required and/or recommended for one type of aircraft; this information will be provided directly to Congress, per the Appropriations Committee language, thereby defining this facet of the research program.

The results of the FAA-NIOSH component will be extended and incorporated with additional research to evaluate applications to additional types of aircraft and to provide a basis for recommending revisions that may be needed for regulations and for content of advisory documents.

15. Schedule/Milestones:

1. New risk estimates of fatal cancer in aircrews taking into account the latest research on low-dose effects and results of the European epidemiology study
2. Continue computational and experimental research. Finalize report on biological survey data and complete data collection for respiratory symptomology component.
3. Complete analytical model development and validation for selected aircraft. Complete biological sampling on aircraft as determined by feasibility survey previously conducted.
4. Complete reports on flow modeling and validation and biological sampling results. Make recommendations for control strategies that could help minimize the risk of disease transmission.
5. Analyze respiratory symptomology data in context of flight history data, and prepare final report of findings and recommendations on environmental requirements for commercial aircraft cabins.

FY01

Q4

Q4

FY02

Q1

Q4

Q4

FY03

Q1

Q4

Q4

16. Procurement Strategy/Acquisition Approach/Technology Transfer:

The procurement strategies will be usual and customary. The research results will be sent to the Office of Aviation Medicine with recommendations as to actions that the FAA should take with respect to standards and rulemaking. The results of the studies will be made available to the aviation industry worldwide and to the scientific community. No equipment purchases above \$5K per item are foreseen for the defined projects.

17. Justification/History:

This research is responsive to the needs of the primary research sponsor (Office of Aviation Medicine). Additionally, this research is consistent with the FAA Research, Engineering, and Development (RE&D) Plan, and directly supports the Bioaeronautics portion of the National Plan for Civil Aviation Human Factors.

18. Issues:

The component of research incorporated within the FAA-NIOSH IA is required by direct language within the Congressional Appropriations guidance to the FAA.

19. Transition Strategy:

Not applicable.

20. Impact of Funding Deferral:

Loss of funding for this task would seriously impair the ability of the FAA to advise FAA policy makers and the aviation community on radiation and other health issues. Loss of funding would also make us noncompliant with a congressional mandate and the requirements referenced in Item # 18 above.

21. R&D Teaming Arrangements:

This research is coordinated with counterparts in the Environmental Protection Agency, the National Institute for Occupational Safety and Health, the National Oceanic and Atmospheric Administration, the National Research Council of Canada, the United States Air Force, the National Aeronautics and Space Administration, the Association of Flight Attendants, the Air Transport Association, the Aerospace Medical Association, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, the American Society of Testing and Materials, and the Society of Automotive (and Aeronautical) Engineers.

22. Special Facility Requirements:

The laboratory tools within the Aeromedical Research Division's Protection and Survival Laboratory and the Toxicology and Accident Research Laboratory are essential to the conduct of this research.

23. Approvals (Signature Authority):**Performing Organization**

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Nancy C. Lane, AIR-3	Date	Director, FAA Civil Aeromedical Institute, AAM-3
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