33. Please describe 3 recent accomplishments of the FAA's human factors research program. Who were the customers for this research, and what agency outputs were delivered to those customers as a result of this research?

- **Budget Item A08b.** The Civil Aeromedical Institute (CAMI) developed the en route Systematic Air Traffic Operations Research Initiative (SATORI) system which uses radar, weather, and voice data recorded at ATC facilities to graphically recreate operational errors and other events that occur within the NAS. The system provides a better understanding of the dynamic conditions prior to, during, and following an event. It is used as a research tool to assess situation awareness and complexity factors associated with operational errors. It has supported several high-profile accident investigation efforts, and en route ATC facilities have used the system to assess adequacy of procedures associated with unusual traffic conditions (e.g. severe weather). Facility personnel use the re-creations for training personnel on factors associated with operational errors/incidents.

- **Budget Item A08a**. With industry, developed an Advanced Crew Resource Management (CRM) Training System for major and regional air carriers. The research addresses proceduralizing the most critical cognitive tasks in the most critical phases of flight. While technical tasks have used procedures abundantly, the human factors area of flight performance has not. This approach improved crew effectiveness both in simulator training and in line operations. Additionally, the project resulted in improved methods for instructor training and assessment of human factors on the flight deck.

- **Budget Item A08a**. Developed Rapidly Reconfigurable Event Set Based Line Oriented Evaluations (LOE). LOEs are a methodology used in Advanced Qualification Programs (AQP) programs to evaluate pilot training performance and establish trainee proficiency. LOEs consist of flight simulation scenarios that are developed by the training organization and approved by the FAA. Software has been developed to allow rapid reconfiguration of separate event sets. This greatly increases the number of LOEs available for evaluation, decreases the risk of compromise, and increases the validity and reliability of the scenarios.

34. What is the FAA doing to ensure that critical human factors issues are addressed in the acquisition and integration of 100% of new and modified aviation systems?

- The FAA has identified four strategies ensure that human factors issues are addressed in acquisition by 2005:
  - Strategy 1: Institutionalize human factors policies. Two Acquisition Management System guidance changes have been implemented, one guidance change has been coordinated for implementation, and two guidance changes have been proposed.

- Strategy 2: Institutionalize human factors processes. Four human factors specialists have been placed to support key programs, concepts for the development of Emulation Prototype capabilities were initiated, and a Human Factors Engineering Process Area was developed.
- Strategy 3: Develop, implement, and support human factors conventions, guidelines, and tools. Concepts for additions to the FAA Human Factors Design Guide have been coordinated, human factors input to standards in the FAA Technical Reference Model have been initiated, and concepts for training (human factors orientation/overview, specialized technical training, tailored and integrated training) have been developed.
- Strategy 4: Conduct human factors assessments. Initial high-level assessments were conducted to determine targeted programs. Targeted programs were assessed to be high cost, high risk, and high visibility with significant human/machine interface considerations.

35. What progress has the FAA made in addressing English language proficiency and controller fatigue?

- **Budget Item A08b**. English language proficiency. In response to an ICAO request and Congressional funding, the FAA has just completed an intensive research effort that addresses English language skill requirements for international Air Traffic Controllers. With assistance from the Defense Language Institute, the FAA has determined a minimal level of English language proficiency in speaking and listening comprehension required to control air traffic. A second outcome will be an evaluation of English language proficiency of Air Traffic Controllers in Latin America. The results of this study will form an excellent foundation for development of an Air Traffic Controller English Language Standard and future training curriculum.
- **Budget Item A08b**. Controller fatigue. CAMI has undertaken a program of research on the unique shift schedules used in FAA Air Traffic Control facilities. The program focuses on circadian rhythm and performance measures with the goal of determining appropriate, targeted countermeasures for disruptions inherent in shift work. Laboratory studies have been completed on the investigation of fatigue and disruptions associated with specific shift patterns, operational errors, and the specific countermeasures of napping and bright lights. The FAA has also collaborated with the US Coast Guard on shift work and crew rest evaluations. A facilities-wide survey of the development of fatigue associated with shift patterns is being developed. A scientific committee of internationally renowned experts has been assembled to address research coordination to ensure that the products benefit the workforce.

36. Please describe 3 recent accomplishments of the FAA's aviation medicine research program. Who were the customers for this research, and what agency outputs were delivered to those customers as a result of this research.

- **Budget Item A08c.** Toxicology and Safety. Supported the investigation of 340 fatal aviation accidents in 1998. Produced test results showing that 9% of pilot fatalities had a positive blood alcohol level, 15% showed indications of over-the-counter drug use, and 14% had taken prescription drugs. Researchers also discovered use of Controlled Dangerous Drugs in pilot fatalities. Postmortem alcohol evaluations developed by CAMI will help determine ingested alcohol versus alcohol developed by the body at death, which will help prevent pilots from being accused of using alcohol when they were not drinking.

- **Budget Item A09c**. Crashworthiness of Aircraft Seats. The agency collaborated with industry research activities to develop improved standards and design practices toward safer aircraft seats. Dynamic impact test programs, sponsored by AIR-3 and ANM-100, were conducted at CAMI in a cooperative effort with the Aircraft Design and Maintenance Center (ADMRC), which is a consortium of aircraft manufacturers, suppliers, and academia. This program was also coordinated with the staff of FAA's Transport Aircraft Directorate (ANM-114) as well as the NRS for Crashdynamics. The work accomplished in 1998 focused on side-facing seats for business jets. The goal of this work is to demonstrate that an equivalent level of safety, as mandated for forward facing seats, can be achieved with side-facing seats and sofas. Implicit in this goal is the desire to minimize the complexity and costs of obtaining FAA certification approval. Recommendations are currently being formulated by the ADMRC Side-Facing Seat Project industry members. The recommendations generated by this will be used by ANM-114 to establish criteria for side-facing seats

- **Budget Item A08c.** Child Restraints. Building on prior FAA research and development, CAMI scientists continued work on improving the performance of child restraints used on commercial transport aircraft. CAMI's Biodynamics Research Laboratory developed new test procedures and pass/fail criteria for aircraft child restraints. The proposed standards developed by CAMI are currently under consideration as the basis for an SAE Aerospace Standard (AS).

A public survey instrument for parents was designed by CAMI researchers to evaluate the impact of the potential diversion of families with children to other less safe modes of transportation if they were required to purchase airline tickets and provide a child restraint for children less than two years-old. Approval to conduct the survey was granted recently by OMB, and plans are proceeding to conduct the survey in 1999.

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37. What progress has the FAA made in the area of cabin air quality.

- **Budget Item A08c.** Under Section 304 PL 103-305, the FAA files an annual report on research that is conducted through an interagency agreement with the National Institute for Occupational Safety and Health (NIOSH). This research addresses the health concerns of flight attendants and passengers and the environmental quality of air carrier cabins. Inflight cabin environmental monitoring for 33 commercial airline flights has been completed under the agreement. The data will: (1) characterize the physical, chemical, and biological parameters of the cabin, and cosmic radiation exposures at various altitudes in common types of commercial aircraft; and (2) provide exposure data for the concurrent NIOSH study of reproductive health in female flight attendants. Two other major categories of data are being collected and analyzed. The first study incorporates respiratory assessments in the NIOSH Flight Attendant Reproductive Health study, which is conducted in partnership with the Department of Defense Women's Health Research Program. The second disease transmission study will utilize aircraft cabin air exposure modeling and measurements to evaluate bioaerosols that can be generated by flight crews and passengers. An analytical model of air flow in an airliner cabin was initiated for use in describing the potential routes of transmission of disease from an infected individual to other airline passengers in the same cabin. This study will investigate the major factors that determine the spread of bioaerosols, such as the tuberculosis bacillus, in the cabin air environment. This information will guide new or retrofit aircraft design to decrease the probability of transmitting infectious agents.