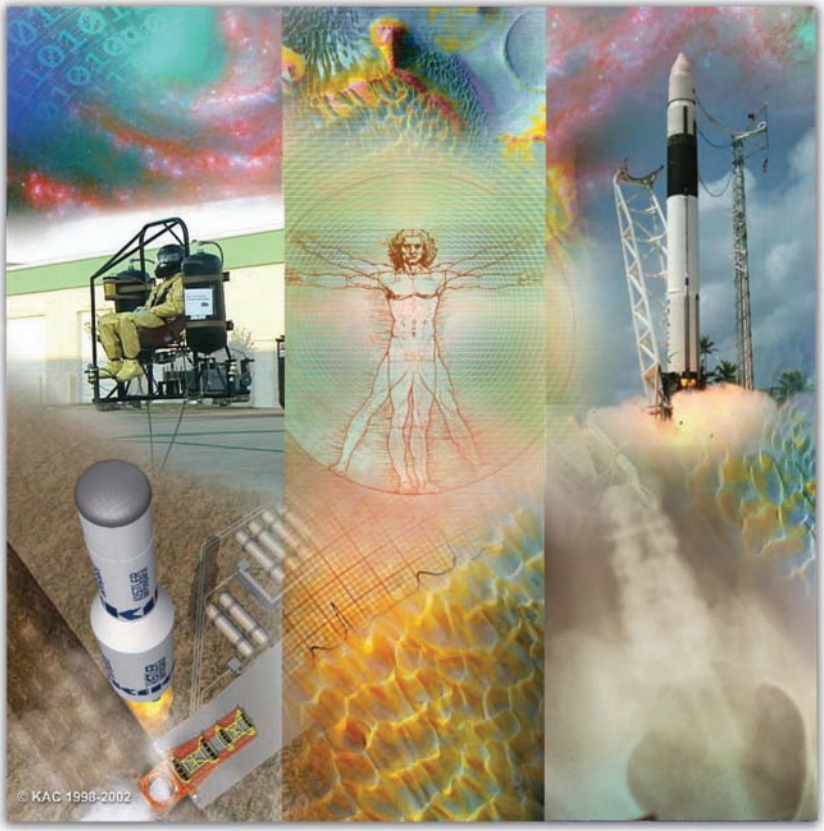
FAA
Commercial Space Transportation



FY-2006
Research and Development Accomplishments

October 2006

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Federal Aviation Administration
Associate Administrator for Commercial Space Transportation
800 Independence Avenue, S.W., Rm. 331
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Mission

To ensure protection of the public, property, and national security and foreign policy interests of the United States during a commercial launch or reentry activity and to encourage, facilitate, and promote U.S. commercial space transportation.

Introduction

Four Research and Development (R&D) projects were undertaken by the Federal Aviation Administration (FAA), Office of Commercial Space Transportation, during fiscal year 2006. Two new research projects were selected. Work also continued on two projects, one initiated in FY 2004 and the other in FY 2005. In addition to a description of each project, a summary of accomplishments to date is provided here.

Safety research supports the development of the policy, standards, and guidance material needed to meet FAA goals and objectives. Such research is also essential in developing the knowledge necessary to maintain and improve Agency materials. Knowledge and materials gained from these efforts are used to verify that the products and procedures of launch and reentry vehicle and site operator licensees and applicants adequately comply with applicable safety standards.

To that end, the Office formulated and instituted an R&D activity to support FAA's strategic goal of safety. The Commercial Space Transportation Research and Development Plan provides a process for effectively applying resources based on clearly identified safety priorities each fiscal year. This plan was used to solicit candidate research projects from internal sources. External sources, such as the Reusable Launch Vehicle and Launch Operations Support Working Groups of the Commercial Space Transportation Advisory Committee, were also solicited.

The process for selecting a research project to pursue is rather straightforward. First, the R&D Advisory Board evaluates candidate research projects for relevance to our mission, relative importance, and cost. Second, the R&D Advisory Board ranks the candidate research projects to arrive at a prioritized list and presents that list to the R&D Senior Steering Committee for review. Third, the R&D Senior Steering Committee selects the projects to undertake.

Selected projects must show the maximum potential to fulfill mission and meet budgeted requirements. Lastly, the R&D Advisory Board and Senior Steering Committee hold periodic project status reviews throughout the fiscal year.

◀◀ *Supports FAA Strategic Goal: SAFETY* ▶▶

Columbia Debris Study

The Office of Commercial Space Transportation, in a partnership with NASA, conducted a study to weigh, measure, photograph, and record characteristics of the debris recovered from the 2003 Space Shuttle Columbia accident. Over 84,000 pieces of debris were recovered. During the recovery effort, GPS latitude and longitude coordinates were recorded for the majority of these pieces. Impact coordinates, along with physical measurements and aerodynamic features, such as shape and ballistic coefficient, can help researchers and analysts develop and refine debris dispersion models used for establishing safety requirements and evaluating public risk associated with space operations.

In 2006, a processing area for this study was established in the Vehicle Assembly Building at Kennedy Space Center, Florida, where the debris is securely stored. Scales, cameras, and other equipment were setup with computers for recording the information into a database. The main objective of this year's effort was to develop and optimize the procedures for processing this large quantity of the debris, which is a labor-intensive task. Based on the results of this procedure development phase, the process throughput and associated costs will be considered and a decision on whether to continue funding the study in FY 2007 will be made.

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Human Space Flight Biomedical Data

The Office of Commercial Space Transportation completed a research project to study commercial human space flight biomedical data. Recent development of piloted commercial reusable launch vehicles created a need for the Office to better understand the physiological challenges space flight places on the human body. The Commercial Space Launch Amendments Act of 2004 requires that space flight participants be informed of the risks associated with commercial space flight operations. However, medical risks of short duration microgravity exposure are not well understood.

The U.S. Government has a compendium of knowledge for young, healthy individuals for long duration space flight. However, this profile does not fit the typical space tourist on a suborbital flight. The Office has the unique opportunity to fill gaps in the knowledge and understanding of how short duration exposure to microgravity affects the human body by collecting medical data on a voluntary basis from commercial space flight participants.

This research project successfully met its objective to define the biomedical parameters recommended for pre-, in-, and post-flight monitoring to form a more complete understanding of the effects of suborbital flight on human physiology. In addition, the project identified and recommended specific equipment and a database format that would be compatible with existing long duration space flight medical databases. Successful completion of this research project has enabled the Office to fulfill regulatory requirements in support of safe space transportation activities. Results of this study allow the Office to recommend the type and method of biomedical data that would be effective to analyze the physiological effects of short duration space flight.

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Debris Risk Analysis

As part of the commercial launch licensing process, the Office of Commercial Space Transportation uses computer-based models to develop casualty expectations associated with launch accidents affecting the uninvolved public. Such models are also used to establish insurance requirements and liability limits.

To validate the computer models used to project commercial launch hazards, the Office examined how well current computer models predict hazards to humans inside buildings that were subjected to external explosive forces. Testing consisted of comparisons between model predictions and historic, real-world incidents. In these comparisons, model predictions and results of explosive debris and blast forces on uninhabited test articles were evaluated.

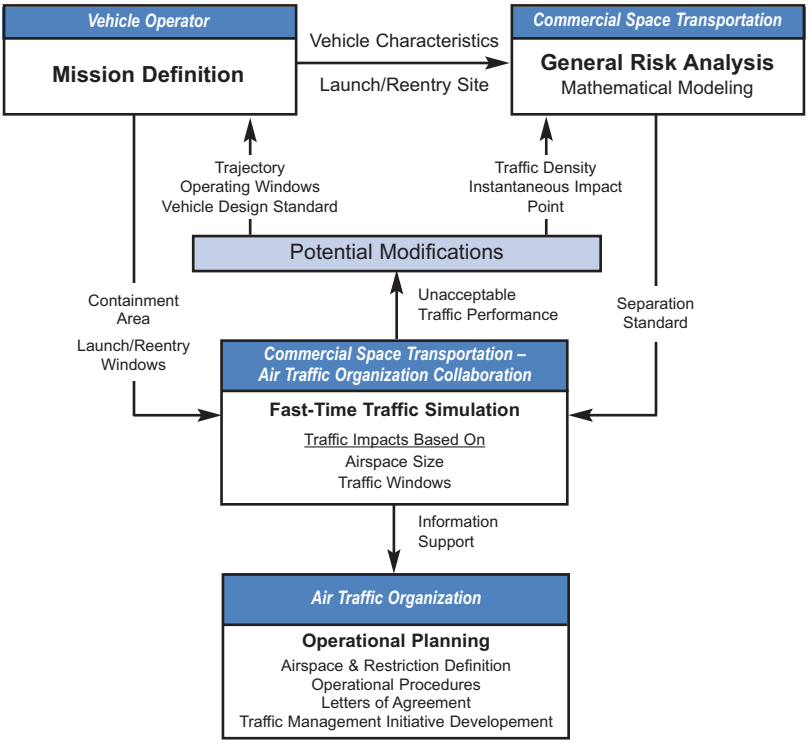
Research results indicated that current computer models show a reasonable correlation between predicted and actual results. The computer models tested, therefore, provide a credible basis for developing insurance requirements and liability limits for commercial launch and reentry activities.

Initial Requirement for Developing Separation Standards for Commercial Space Transportation Operations in the National Airspace System

FAA, Office of Commercial Space Transportation performed a research study to identify initial requirements for developing separation standards for aircraft and commercial space transportation launch and reentry operations in the National Airspace System (NAS). Ensuring public safety requires sustained efforts to improve processes and approaches as the commercial space transportation industry evolves. With a focus on the rapid evolution and complexity of new launch and reentry vehicles, the Office leads agency efforts to establish new processes to evaluate and approve safety critical launch vehicle components and systems. To that end, the FAA conducted safety-related research on identifying the initial requirements for the development of separation standards for aircraft and spacecraft.

Figure 1 shows the separation standards development methodology. Vehicle operators define the vehicle and space mission characteristics. General risk analyses then determine initial separation requirements based on space vehicle and launch site characteristics. Then, fast-time simulations test the combination of mission and separation requirements within a high-fidelity model of the actual air traffic environment.

FIGURE 1. Separation Standards Development Methodology



If the initial separation criteria and mission requirements result in unacceptable traffic impacts, then alternate vehicle characteristics, mission characteristics, and other risk analysis parameters are proposed that will mitigate those impacts. The results of this process will support development of the operational information needed in the field to conduct the mission. Such information will include operational procedures, agreements, and airspace design.

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Commercial Space Transportation

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