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STATEMENT OF JAMES M. BEGGS, UNDER SECRETARY OF TRANSPORTATION, BEFORE THE SENATE COMMITTEE ON AERONAUTICAL AND SPACE SCIENCES ON AERONAUTICAL AND SPACE RESEARCH AND DEVELOPMENT, TUESDAY, APRIL 11, 1972.

Mr. Chairman and Members of the Committee:

I appreciate this opportunity to review for the Committee the activities of the Department in the field of aeronautical and space research and development.

The Joint DOT/NASA Civil Aviation R&D Policy Study was completed in March 1971. As you are aware, it took its direction from the concerns put forth by this Committee in Senate Report No. 957. The Study was very comprehensive and conducted in-depth. The group recommended action after taking into account near-term programs that were under way and the ability to apply new technologies to existing functions. It identified that there were limitations on actions due to institutional constraints. In some cases, the authorities vested in either the Department or NASA are not clear. The Study's primary objective was to highlight those points and to identify the opportunities for new applications.

In both DOT and NASA, actions were implemented in response to the recommendations of the CARD Study before the publication of its final report. The direct involvement of personnel in responsible positions assured that the deliberations which produced the CARD recommendations were known to those people responsible for implementation, before they went to final print. Consequently, there are many actions that initiated programs which are, in fact, responsive to the CARD recommendations which predate the publication of the final report.

Immediately following the publication of the report by its sponsoring organizations, action was taken within the Department to review the recommendations of the CARD study to facilitate the development of a CARD implementation plan. It is clear that development programs must be implemented which will make possible growth of acceptable public and private transportation of all forms.

While the primary focus of our aeronautical application is, in fact, the civil aviation system, the aeronautical system disciplines are effectively applicable to all modes of transportation. A great strength of the aeronautical activity is in the development of systematic processes of evaluating cause and effect relationships.

The application of new technologies can improve the environmental quality of all transportation, relieve congestion, improve efficiency, and increase safety.

The overall activity consolidates and strengthens the drive initiated in previous years to develop a total R&D program that moves technologies associated with transportation forward to meet national objectives and priorities. A major objective of the overall program includes a better, more productive, safer aeronautical transportation system with maximum protection for the environment.

The programs which address this represent a balance between solving crucial current problems and longer range activities directed toward application of advanced aeronautical transportation technology. As the technology program develops in future years and is reflected in the effectiveness of

departmentwide programs, it is anticipated that the emphasis in the technology program will shift further towards long-range projects.

Major emphasis is being focused in the aeronautical and space areas on increasing air transportation capacity, noise abatement and pollution control.

Our work to improve the air traffic control system is a continuation and expansion of the air traffic capacity program started in fiscal year 1970 which is aimed at the full automation and capacity increases of major urban airways and airports. This activity responds to the CARD Study recommendations for reducing congestion and improving the total air transportation system, including airports and their access, while fully minimizing environmental effects.

Noise abatement is receiving expanded effort. Research is required on the major sources of noise and its attentuation, so compatibility with the environment can be obtained. Major emphasis is being directed toward the demonstration of practical applications of noise reduction techniques to all existing transportation vehicles and the solution of noise problems of future transportation systems of all modes.

Pollution control will continue to receive emphasis because, in addition to addressing serious pollution problems which have been imposed by transportation vehicles during the past few years, we must also determine the effects on the environment of the forthcoming world-wide high altitude aircraft operations. A large portion of the funds requested for minimizing environmental side effects are devoted to the special problems of climatic effects on high altitude supersonic flight.

The DOT and NASA have a Coordinating Committee to integrate DOT and NASA programs defined in the CARD Study. The objectives of the Committee are to eliminate unwarranted duplication and to achieve maximum return from resources. The Committee has identified seven major areas for formal coordination: ATC, navigation, collision avoidance systems, communication satellite, V/STOL system development, noise and advanced high-speed transports. In each of these areas, specific FAA/NASA representatives have been designated to act as points of contact for coordinating R&D programs.

The following major technical areas are highlighted in terms of NASA/FAA roles, achievements and plans:

NASA/Ames Support

FAA established an FAA group at the NASA/Ames Research Facility, for the joint use of this simulating facility, to develop certification criteria. Maneuvers can be made on the simulator for research and training purposes, and limitations of the man and/or the machine defined. In 1972-73, this group will complete the simulator test pertaining to the high-speed certification requirements.

V/STOL Joint Program - Navigation/ATC

FAA is providing support for an interagency (DOT/NASA) V/STOL program. NASA is currently modifying an existing aircraft with an augmented lift capability and the FAA will join with NASA in using this aircraft as a test vehicle to determine navigation guidance, ATC and surveillance

requirements for the development of a viable V/STOL air transportation system. These are important building blocks in the development of capability leading to the use of a STOL research vehicle for developing criteria comprehensively.

Microwave Landing System

In the Mocrowave Landing System development the efforts of DOT and NASA are closely related and complementary. FAA has program responsibility for the development program with industry. This program seeks to establish the design of ground and flight equipment to serve a broad range of users. NASA's role is the development and test of the necessary avionics to permit the utilization of Microwave Landing System capabilities in STOL aircraft. This application will involve use of some of the most sophisticated flight profiles the Microwave Landing System is intended to accommodate.

Satellites

FAA established a program to conduct experiments necessary to characterize the space channel and to test and evaluate selected signal formats for application in Oceanic and CONUS ATC Systems. This experimental program is being conducted in coordination with NASA ATC related experiments which include the PLACE (Position Location ATC Experiment) on an ATS-F and the proposed experiment on an ATS-G. L-Band channel characteristics were evaluated using ATS-5. These measurements provided engineering and scientific data on multipath characteristics in oceanic areas. A report is in preparation. We

will continue these experiments to provide further data on channel characteristics, voice intelligibility, digital data link error rates and surveillance system accuracies. A report is planned in December 1972.

A joint DOT/NASA Planning Group will define the experiments to be conducted using the ATS-F satellite scheduled for launch in late CY 1973 or early CY 1974. This group will provide the experimental plan by June 1972. In addition, supporting activities including development of required avionics and test hardware will be initiated.

Flight Safety Criteria

FAA is coordinating R&D improved aircraft certification criteria all classes of aircraft. NASA is participating in this program in the special areas of V/STOL, SST aircraft, and general aviation aircraft by providing technical and facility support.

Accident Prevention

FAA is conducting R&D programs for the purpose of improving certification criteria. NASA is working jointly with the FAA and providing aerodynamic load data for FAA assessment of validity of current certification regulations. We expect NASA will continue to provide data to meet future certification needs.

Accident Survival

FAA is conducting R&D programs to improve techniques for fire and impact protection of occupants of all classes of aircraft. NASA is conducting tests to develop applications of space technology to civil aircraft fire and

impact protection. FAA programs are demonstrating that materials with improved flame resistance and reduced toxicity can be applied to cabin interiors and NASA has demonstrated exterior aircraft fire resistant coatings. This is a continuing FAA and NASA program.

Environmental Protection

Aircraft engine retrofit feasibility studies to reduce aircraft noise are being conducted by DOT/NASA Joint Offices. The planning of complementary programs designed to develop retrofit options has been started. Specific roles were assigned to FAA and NASA in the implementation program. NASA's development work is planned for initiation in 1973. FAA/NASA and NASA/Ames are also developing a joint test program to determine the pilot-aircraft relationships and instrumentation required to allow use of segmented and steep approach techniques.

The technology that has been developed in aerospace application is now being brought to bear in the solution of broad transportation problems. The aerospace community, both public (NASA) and private (industry), currently provides strong support to DOT in the aeronautical, noise abatement and tracked cushion vehicle system areas. This support is being extended to include urban mass transportation systems as well. We have nearly two dozen interagency agreements with NASA in various areas and are constantly seeking ways of utilizing aerospace technolgoy for the solution of transportation problems.

Some examples of aerospace technology being applied to the solution of transportation problems include the following areas:

1. Magnetically Levitated Vehicles (MAGLEV) - Aerospace cryogenic technology is being applied to create the high magnetic flux fields required in this type system.
2. Tracked Air Cushion Vehicles (TACV) - Aerospace propulsion, structures, and command and control technology is being applied to research and assess the potential of high-speed, efficient surface transportation systems which have many of the characteristics and performance requirements of aerospace systems.
3. Vessel Traffic System (VTS) - Aerospace radar and command and control systems are being applied in the solution of vessel traffic control problems, similar to those experienced by aircraft in air traffic control situations. Development of VTS components, including computer programs and display systems, is in progress.
4. Morgantown Personal Rapid Transit System (MPRT) - An aerospace company is the prime contractor and the systems integrator for the MPRT System. Aerospace structures, propulsion, and command and control technology is being applied to the development of the MPRT System.

The Transportation Systems Development and Technology Aeronautical and Space Programs (sponsored by the Office of the Secretary of Transportation) outlined below are proposed for funding in fiscal year 1973 at the level of $17.5 million. This is consistent with the national objectives and priorities for the

development of a safer aeronautical transportation system with maximum protection for the environment.

The specific programs to support these objectives are as follows:

1. ADVANCED AIR TRAFFIC CONTROL SYSTEMS

The fiscal year 1972 activity resulted in the definition of several operational and system implementation concepts which appear to have the potential of satisfying projected requirements for the post-1980 period. These studies, conducted at the Transportation Systems Center with the support of several major contractors, have indicated specific areas where additional concept definition is necessary and where experimental activity is required.

The fiscal year 1973 activity will evaluate the several operational and system implementation approaches which have been proposed, and by simulation and analyses conduct trade-off studies of the most important parameters.

2. AIR PASSENGER TRANSPORTATION SECURITY

The anti-hijacking programs that were begun in fiscal year 1971 and continued into fiscal year 1972 have primarily addressed the problem of detecting weapons carried by boarding passenger selectees. It is believed that the basic technology to do so has now been brought within the state-of-the-art and provides for highly effective screening systems that will prevent travelers from boarding aircraft

carrying weapons such as guns and knives. The key to effectiveness now lies with the consistent use of systems that are available. In fiscal year 1973, work will emphasize bomb detection systems to examine passenger hand-carried luggage.

3. SATELLITE TELECOMMUNICATIONS

The applications of spacecraft problems in marine, surface, and air transportation is continually being evaluated by DOT. In several areas we are working with NASA to define experiments which will provide DOT needed information to aid in the solution of problems related to communications in the various modes of transportation, as well as the applicability and benefits from the use of satellite technology for position fixing.

4. RESEARCH PROGRAM ON NOISE GENERATION MECHANISMS

Research on jet noise generation mechanisms and associated special laboratory testing techniques will be continued and a study will be undertaken to develop an adequate analytical model of supersonic jet noise generation. The second increment of support for an extensive engineering research project on high-speed jet noise source location and reduction is included in this program.

These activities have been planned and initiated within the framework of the Joint DOT/NASA Office of Noise Abatement program planning to provide a comprehensive attack on the unresolved and very complex problem of suppressing noise generated by the jet mixing process. It is anticipated that only through such a concerted effort involving industry, government, and university scientists and engineers can we evolve the needed basic solutions to the jet noise problem so that the development of future aircraft is not constrained by noise considerations.

5. NOISE MEASUREMENT, ANALYSIS, AND INFORMATION

The airport Noise Reduction Forecast Program initiated in fiscal year 1972 to provide the Department with the quantitative information necessary to act objectively to reduce airport/community noise incompatibility will be completed. This program will support the retrofit program in its entirety by evaluating the economic/technical results of the ground and flight test programs in terms of the costs to modify the fleet and the effectiveness of noise reduction to the airport neighbors and will provide a basis for the rulemaking process. Technical feasibility is one aspect of the retrofit program. Equally important are the economic implications and the overall effectiveness of the retrofit.

A technical/economic analysis is being conducted to determine the degree to which incompatible land use around airports is reduced as a result of the various retrofit options, the cost of attaining compatibility, and the alternative means of financing the retrofit program. The tradeoff criterion will be the relative cost-effectiveness amongst the various alternatives.

6. CLIMATIC IMPACT ASSESSMENT PROGRAM (CIAP)

This program to assess the environmental and meteorological effects of the projected world high-altitude aircraft fleet, including subsonic and supersonic vehicles, was initiated in fiscal year 1971, given substantial new impetus in fiscal year 1972, and reaches its peak of activity in fiscal year 1973. It is designed to provide a necessary part of the base of knowledge required to support Federal policy decisions concerning the operation of supersonic aircraft over territory under the jurisdiction of the United States. It addresses the complex interactions between the engine emissions exhausted into the upper atmosphere, the material composition of the stratosphere, and the dynamic processes of the atmosphere. It examines the effects of projected changes in the upper atmosphere upon the climate close to the earth's surface.

Air Traffic Control Systems and Systems Criteria

Although almost all of the activities related to the FAA's responsibilities are associated with the application of aeronautical and space technology, much of the activity is specifically a result of statutory responsibilities to operate an air traffic control system. NASA supports this activity with experimental work and technical support. The areas in which there are mutual interests are in the system development and criteria, in communications, displays, navigation facilities, terminal control, application of satellite communications, aircraft safety, environmental protection, and aviation medicine. Our budget requests for FAA activities, including requests under the research and development appropriation and the general appropriation, amount to approximately $40 million under the general headings of V/STOL Systems and Criteria, Collision Avoidance Systems, Terminal Control, Navigation, Aircraft Safety, Aviation Medicine, and the largest of the items, Environmental Protection.