STATEMENT OF DR. JOHN L. McLUCAS, ADMINISTRATOR OF THE FEDERAL AVIATION ADMINISTRATION, BEFORE THE SUBCOMMITTEE ON AVIATION AND TRANSPORTATION R&D OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY ON THE FUTURE OF AVIATION, MAY 11, 1976

Mr. Chairman and Members of the Subcommittee:

It is expected that witnesses testifying before Congressional Committees will express their pleasure upon appearing. I want to depart a bit from that opening and say that this is far more than a pleasure for me, it is a sincerely welcome opportunity.

Last week, Secretary Coleman outlined our approach to the fundamental issues being addressed by this Subcommittee. Mr Chairman, in your opening remarks, you summed up the issue by saying that we must "find a way to make the necessary investment to maintain our lead in aviation." Of course, by investment you didn't mean solely money. Money, while an important ingredient in any R&D program, is only one resource and it is not the most important one. The most important resource the Federal government can provide is direction-and once that is established, the leadership to move forward. It is with this resource that the government, even with a limited monetary commitment, has the leverage to impact greatly on the course of aviation.

To gain a better perspective on the future, I think it's worth taking a few minutes out to study the past achievements of the aerospace community.

Over the years, it has been the steady development of technology that has made the U.S. pre-eminent in the field of civil aviation. From 1925 through 1940, the growth of the industry was measured by advances in technology which: 1) increased engine power and efficiency--the radial air-cooled engine and the controlled pitch propeller; 2) reduced drag and lightened structures--retractable landing gear and high strength aluminum alloy; and improved the safety and economy of flight--two-way radio communication and pressurized cabins.

Military demands during the period from 1941 through 1950 created a need for more speed, altitude, range, and load-carrying capability. These requirements resulted in the advent of the turbojet engine, swept-back wing, titanum alloys, and, eventually, supersonic flight. The military need to fly aircraft in all weather was answered by a ground based weather radar system for detecting and tracking hazardous storms and to assist aircraft in avoiding them by Doppler radar for navigation independent of ground stations and by an instrument landing system with which pilots could be led to safe landings in low visibility weather or at night.

Developments in airborne electronics provided a significant portion of the advances in the aviation industry in the Sixties. Included among

these are the inertial navigation system, to measure an aircraft's position in space without recourse to externally generated information, airborne digital computers, and communication satellites providing global coverage not achievable with any other type of communication network. Reliability and the safety of flight operations were increased in this decade through the development of computerized flight plans, digital flight simulators, and the use of weather satellites.

Recent years have shown no decrease in technological innovations for aviation. In fact, the technology to build our next commercial transport plane is on the shelf today. We have the supercritical wing, which improves high-speed flight performance by further delaying the drag rise that occurs near sonic speed. We have advanced composites to improve structural strength and reduce weight. High bypass ratio turbofan engines give greater thrust, with reduced fuel consumption, noise, and air pollution.

From a doped linen wing to a supercritical one, the list of technological innovations in aviation has been both broad and extensive enough to meet the changing demands of both the U.S. public and its economy.

Many of these innovations were developed from a technical base established by DOD research and development and I believe that

they will continue to assist us in future aviation development. However, the nature of the relationship between military and civil research and development has changed. The days of "direct" transfers of technology and equipment from the military to the civil, such as the Boeing 707 from the B-52/KC 135 family are largely gone. These are the days of derivatives, where concepts, not hardware, developed by the DOD, are adapted by civil R&D to produce commercial designs. Even this source, however, appears to be drying up. New military aircraft are being designed to fly faster and carry compact weapon systems. Those goals are not the goals of civil aircraft today. This is the crux of the problem. We do not share identical design objectives with the military. Today, our new civil aircraft are expected to be efficient, quiet, clean, as well as safe. While DOD shares these objectives, they are viewed from the perspective of military mission accomplishment. The technology is available, what is currently lacking are major purchases which will spark commercial offshoots. This absence is leading to the development of the "Ten-Ton" engine by private effort. I don't want to leave the wrong impression, DOD R&D and civil R&D are not working in either totally different or opposite directions. Rather, in many areas, we are on parallel tracks and, to make the technology transfer, we must bridge this gap. To continue this metaphor one step farther, we also must decide where to build that bridge, what areas of military R&D

we could use for civil needs and when we should build it. Also, in some cases, we must decide how the FAA can influence the Department of Defense in the direction their research might take. This is an area where the FAA can play a vital role in the identification of technological innovations that can hopefully lead to productivity gains.

Communication--information exchange--at all stages of the program and at all levels of decision making is a vital part of this process. Secretary Coleman described the formal structure that exists to exchange ideas. There is also an informal structure, based on day-to-day personal contact between FAA and DOD personnel. There is also interchange of personnel--I guess currently I'm the outstanding example. One FAA objective in these contacts is to ensure that military requirements are properly considered in our plans for airspace management. A prime example is in the Microwave Landing System (MLS) evaluation, where military and FAA personnel are working together to achieve a compatible system. We also participate in many on-going DOD research and development projects which have potential commercial adaptability. These include V/STOL and helicopter development, "active control" systems, and avionics.

The establishment of cooperative test facilities is another example of this cooperation. As far back as 1966, the FAA, DOD, and NASA

participated in a Joint Air Agency Conference to establish requirements for a new phase of Test Facilities for similar R&D objectives. Three facilities recommended as a result of this study are now either being proposed or have been implemented. They include a cryogenic transonic wind tunnel, the newly proposed Aeropropulsion System Test Facility, and the modification of the 40 by 80 wind tunnel at NASA Ames for low-speed research. In addition, existing test facilities are being used jointly. A DOD/FAA program is now underway at the Flight Dynamics Lab at Wright-Patterson AFB where, under the military's Terminal Area Guidance program, simulation studies and flight tests are being conducted.

A NASA/DOT/FAA Coordinating Committee has identified the major subjects for formal coordination between those agencies. These include aircraft safety, aircraft noise, air pollution, short haul air transportation, terminal area operations, and wake turbulence. We have broken these topics into specific working level assignments, mutually identifying project goals and resources on a continuing basis.

In our continuing coordination with the private sector, a large portion of our upcoming Eighth Annual Aviation Review Conference will be devoted to discussing ideas for the formulation of future plans in airspace management. This Conference, open to all, will be here

in Washington on May 24-26. One entire day will be devoted to a joint government and user panel on the Government's Role in the Future of Civil Aviation. We welcome your participation, again this year in that Conference, Mr. Chairman.

Secretary Coleman has already indicated how the Aviation Act of 1975 will be the longer term solution to the premier problem for the airlines--capital formation. It's short term effects will be less dramatic and the FAA is playing a key role in providing some near term relief. One way is by increasing efficiency in the use of the airspace--delays cost the airlines $250-$500 million annually and they are projected to reach $1 billion annually by 1985, unless new options which increase system capacity, are implemented. The implementation of the UG3RD is pointed at reducing such delays. But, present R&D programs underway are not geared to solving the immediate economic problems of the airlines.

For this near term, the FAA is studying and implementing, with industry's support, operational programs which will increase airline productivity by lowering operating costs. Two of these programs are now undergoing evaluation at Chicago's O'Hare Airport. Using three sets of parallel runways for arrivals and departures, the capacity at O'Hare has been increased by up to 25%, decreasing delay time, while at the same time reducing the workload of controllers by allowing easier flow and avoiding congestion.

A new technique already available to airlines is the use of a "high profile descent" that not only reduces the noise level but, in a recent test, saved about a thousand gallons of fuel per landing. In another operational program under evaluation, called Fuel Advisory Departure, delays were avoided and a considerable reduction in fuel consumption was experienced by simply keeping aircraft at their departure airports whenever the destination airport experienced major delays due to weather. Since the airlines are notified from 60 to 90 minutes prior to their expected departure time, passenger inconvenience can be minimized. During a recent 6-hour test period, the airlines saved over 650,000 gallons of fuel.

These are examples of procedures which can properly be called "technological" innovations even though new hardware wasn't developed. They represent a synthesis of existing equipment with innovative ideas generated by both industry and government.

The FAA does have underway a variety of R&D projects which were the subject of an earlier hearing before this Subcommittee. To save time, therefore, I will just hit the high points.

As air traffic continues to grow, the capabilities of today's air traffic control system and airport runway capacity are becoming more and more strained. The present semi-automatic system is inherently limited by controller workload, by available airports, and by dated technology. We cannot continue to accommodate more and

more aircraft into the system without trading off safety and efficiency. Since safety cannot be compromised, congestion will increase, delays will become more severe, and the system will stagnate. To relieve this situation and to provide for growth in the air traffic system, we are taking the following steps:

- We are developing the Upgraded Third Generation Air Traffic Control System in which automation is the key. We have set safety, performance, and cost goals for the future.
- The Discrete Address Beacon System seeks to improve the communication interface between the controller and aircraft through a data link, which provides more accurate identification and position information.
- A collision threat/detection warning capability further reinforces ATC ability to assure adequate airborne separation of aircraft.
- Utilizing broader operational data from new systems such as wind shear, wake vortex avoidance and airport surface traffic control, airport capacity can be increased and safety enhanced.
- The Microwave Landing System is expected to offer more site-sensitive precision landing guidance, and Area Navigation will reduce controller communications and shorten flight paths.
- Automating pilot briefing and flight planning can increase the productivity of the flight service station specialist, while, at the same time provide general aviation with more accurate

weather information for safer flying.

- The Aerosat program should demonstrate whether we can provide more reliable oceanic communications and accurate position data and provide additional insight on the role of satellites in ATC systems for the future.

Another major goal is to continue to reduce adverse aviation environmental impacts by developing solutions supported by economic and technological feasibility studies. In determining which R&D programs to pursue and their relative priorities, the FAA considers the overall costs and benefits. This assessment includes, not only direct costs and benefits, but also environmental, safety, energy, and social factors. We, also, are going to actively explore improved airport design and safe and efficient ground handling of aircraft. I believe we need to begin to increase our understanding of the airport/landside relationship, especially if we find airport access is becoming a major restraining factor on airport capacity. The Federal government may then provide needed direction through a coordinated program with the other interested public and private sector parties. Lastly, we want to continue to develop measures to enhance passenger and crew safety through aero-medical research, emphasizing crash survivability, through increases in pilot and controller performance, and through anti-hijacking and explosive-detecting measures.

One bright spot in the aerospace manufacturing picture has continued to be general aviation aircraft. At the FAA, programs are designed to encourage the growth of general aviation, while mindful of the necessity to keep the use of the airspace an orderly process.

Improvements in increased safety and reductions in operating costs are being provided to general aviation through several of the programs within the UG3RD. A major program in this regard involves the flight service stations. We are modernizing these facilities to improve service by providing more accurate and more timely information to pilots on weather and other flight conditions. Through automation efforts, flight service station specialists will become more productive in supporting private pilots and the safety of general aviation flights should be enhanced.

Another program which will result in improving the safety of general aviation operations is use of the Microwave Landing System. This system will provide precision instrument operations at many more small community airports than would otherwise be possible because of siting restrictions. At larger airports, the Wake Vortex Avoidance System (WVAS) will assist general aviation aircraft to flow efficiently into the terminal.

The Discrete Address Beacon System (DABS) with the proposed Intermittent Positive Control (IPC) service should preclude the need for expensive Airborne Collision Avoidance System (ACAS) and will provide relatively low cost separation assurance service, through the use of a beacon transponder and simple cockpit display. The major effort in this and other programs is to provide general aviation with a safer, more efficient, air traffic system which can be adopted to meet its needs. And, when avionics are required for this purpose to assure the availability of low cost, reliable units designed specifically for general aviation.

Those are programs underway now. But, the projected growth of aviation, continued operational developments, and new technology demands a long-range research program designed to meet future needs. Even the most conservative growth projections indicate that the UC3RD will become inadequate by the 1990's. Therefore, over the next few years, we expect to significantly increase our long-range research activities. The goals of our long-range research program are to provide at reasonable cost, adequate capacity, acceptable levels of safety consistent with resource conservation and environmental protection. In keeping with these goals, the program is directed toward NAS development, aircraft and flight operations, research, and basic technology studies.

The FAA long-range research program for the National Airspace System is designed to find ways to minimize expenditures of manpower, energy, and other resources in the post 1990 time period. The long-range research program will develop the key elements needed for the implementation of a fourth generation ATC system. It is envisioned that some form of massive automation of the basic control process will be needed to stem rising manpower requirements. New control techniques will be required to provide adequate capacity. Integration of the system functional elements of surveillance, position fixing, and communication will be necessary to keep system costs low. Extensive tradeoffs between ATC system elements will need to be performed to minimize both system costs and airborne equipment costs. Extensive lead time is required to complete the analysis and experimentation of major elements in the national airspace system before the decision can be made to develop, test, and implement them. We must, therefore, identify now, the goals of long-range research.

In the interest of time, I have attached to my statement three charts which detail long-range R&D areas we are exploring. We hope to identify any of these projects that merit Federal expenditures based upon the criteria established by Secretary Coleman in his National Transportation Policy Statement.

Deciding on the research and development program needs for the Seventies demands a prediction of the requirements in the year 2000 and beyond. Consider the uncertainties which inevitably arise during so long a period. We need only look back over the past 25 years--who then could have predicted a manned lunar landing, 500 passenger aircraft, or supersonic transports? One is tempted to throw up his hands and say, "forget it." We cannot afford to do that.

Mr. Chairman, these hearings demonstrate your recognition that under the existing economic climate--with the advent of increased foreign competition--we cannot wait for R&D innovations to just appear magically. Nor can military research be counted on to provide the only spawning ground for future advances. The civil side must take affirmative steps to see that long-range R&D is performed in a timely fashion. The first step is to stop thinking of long-range R&D as a misty, abstract concept in the dim, distant future. Secretary Coleman has charged us with determining long-range R&D needs and with identifying the proper Federal role in projects we have identified. The FAA is fulfilling its leadership responsibility and responding to this mandate by turning projected needs into concrete programs, as shown on the attached charts. The next step is a review of these programs by other Federal agencies and Congress, as well as private organizations in the

aviation R&D family. Then, once these programs have been developed to the point where the private sector is satisfied that a market exists for the product, economic forces in the market place will provide the incentives for financing their continued development.

The technological needs of the future must be planned for today. You, Mr. Chairman, and Members of the Subcommittee, are to be commended for your active participation in this endeavor.

Thank you very much.