STATEMENT OF NEAL A. BLAKE, DEPUTY ASSOCIATE ADMINISTRATOR FOR ENGINEERING, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND MATERIALS, CONCERNING THE APPLICATIONS OF NEW TECHNOLOGY TO AIRPORT SAFETY. JULY 18, 1983.

Mr. Chairman and Members of the Subcommittee:

I welcome the opportunity to be here today to discuss FAA's efforts to apply new technology to airport safety. With me are Chip Mudd, Director of the Office of Airport Standards, and Ken Hunt, Director of the Office of Flight Operations.

FAA carries out its duty to ensure airport safety through two main regulatory functions: airport certification, and the establishment of flight operations criteria. Currently, the law empowers the Administrator to issue airport operating certificates and set minimum safety standards for the operation of airports serving air carrier aircraft designed for more than 30 seats. FAA's Airport Standards Office sets the criteria for certification of airports under Federal Aviation Regulation Part 139. The minimum safety standards cover such things as marking and lighting of runways, thresholds, and taxiways; pavement maintenance; crash, rescue, and firefighting equipment; and airport emergency plans. At the present time, FAA is engaged in a comprehensive review of the standards set out in Part 139. In fact, we held a public meeting on July 14,

in an effort to get the views of system users on possible ways to revise and improve our standards. The information and ideas received at that meeting are undergoing thorough review and will be taken into consideration as the agency proceeds with its efforts in this area, which may result in a notice of proposed changes to Part 139.

Turning to flight operations, FAA's standards in this area are designed to ensure the safety of flight. Those dealing with take-off and landing are especially important, since these are critical phases of flight. Naturally, airports throughout the country vary in terms of layout, surrounding terrain and buildings, and the like. These factors can limit the feasible approaches to any given airport, and thus are extremely important considerations in establishing operational procedures/instrument approach minimums for an airport. Establishment of an instrument approach at an airport is based on criteria that consider the visual aids available, terrain and local construction, the type of aircraft that will use the approach, other navigational aids serving the airport, and the effect of air traffic operations at other airports in the vicinity. This is a complex process and FAA has laid out definitive guidelines for establishing minimum altitudes for each segment of an approach. Following these guidelines, a technician designs an approach that assures the pilot a safe

altitude which will clear the terrain and ground based obstacles under the flight path during the instrument portion of the approach and any subsequent missed approach. Our flight operations standards are designed to take into account all relevant factors at each airport, and they are carefully tailored so that the approaches we prescribe are safe for that particular airport.

Another relevant factor which is taken into account in developing operational procedures around airports is noise. Section 611 of the Federal Aviation Act directs the Administrator to "prescribe and amend such regulations as the FAA may find necessary to provide for the control and abatement of aircraft noise ...". We take that mandate very seriously, Mr. Chairman, as part of our overall mandate to provide for a safe and efficient system of air transportation for this nation. As we forecast the inevitable demand for more and more air transportation, we also see the continuing, and increasing, constraints imposed on airport capacity due primarily to public and local concerns about noise impact. We know that we must do all that we can to control noise if we are to continue to provide an efficient transportation system.

Consequently, we have undertaken rules and regulations to limit the noise of newly designed, and newly manufactured airplanes.

We have imposed a scheduled program of noise compliance for older, noisier airplanes, so that, beginning January 1, 1985, those older airplanes must be modified to provide quieter operation, or be retired from service in the United States. To complement noise reduction at the source - the airplane itself - we also continue to evolve and tailor operational procedures around airports to minimize the noise impacts there. But, our first concern, mandated by Section 611 of the Federal Aviation Act, must be that any such procedures are "consistent with the highest degree of safety in air commerce or air transportation in the public interest". The FAA does not advocate nor will we approve any noise abatement operational procedures which may place an aircraft outside of its safe operational envelope. Thus, noise abatement departure procedures may involve a slight reduction in engine thrust, or a more-rapid clean-up of gear and flaps. During approach, the crew may delay deployment of flaps and gear extension, to minimize thrust requirements, and as a consequence generate less noise. In all cases, there are minimum air speeds, maximum bank angles, and minimum thrust settings which must be observed to provide a safe operational envelope for the aircraft. Our constant task is to tailor near-airport operating procedures to minimize noise on airport neighbors, while at the same time maintaining that highest degree of safety which is essential for the traveling public.

Against this background of FAA's regulatory responsibilities regarding airport safety, I would like to turn to the topic of FAA's research and development efforts designed to apply new technology to improve airport safety. Mr. Chairman, some of our most important programs have been discussed extensively in recent hearings before this Subcommittee. Due to your familiarity with them, I will touch on them only briefly, but in no way is this meant to detract from the significance FAA attaches to these programs.

WIND SHEAR

One important program we have concerns wind shear. The National Academy of Sciences Study funded by Congress is well underway with a final report due in September. This report will contain recommendations for the communication and display of low-level wind information and warnings to pilots and air traffic control personnel, along with recommendations for improving our ability to conduct safe aircraft operations while taking into account potential hazards due to low level wind shear. These recommendations will be considered in defining our further program efforts in this area.

A related effort is the expanded Low Level Wind Shear Alert System (LLWSAS) test bed in New Orleans. By doubling the

number of sensors and increasing processor and display capability, we expect to be able to detect smaller wind shear phenomena than the current network. We expect to receive data from the enhanced system early next year. It must be recognized, however, that enhanced LLWAS will still only detect shear conditions existing in the airport area. Detection of shears in the approach and departure areas must await the implementation of the Next Generation Weather Radar (NEXRAD) program.

JAWS

The Joint Aviation Weather System (JAWS) program has provided significant data on downburst and microburst wind shear conditions associated with thunderstorms. These data will be analyzed and studied through 1984, and the results of this research effort will be used to improve the forecasting of severe weather phenomena, and in the design of new systems such as NEXRAD. JAWS data is also being used to provide improved wind shear profiles for use in pilot simulator training. We are also preparing a new pilot training film to incorporate the latest information derived from the JAWS program. In addition, we are examining our wind shear advisory circulars to update them as appropriate. Pilots are currently being trained in the

proper techniques for operating in wind shear conditions, particularly on takeoff.

NEXRAD

The NEXRAD program is moving ahead on schedule, having just entered the validation phase. This phase is scheduled for completion in 1986, and the first delivery of production systems should occur in FY 88. Analysis of JAWS data has indicated that NEXRAD type coverage will be required in terminal areas. Coverage of the planned NEXRAD enroute grid indicates that some terminal type units will most probably be required. We are currently developing a plan in this area.

SURFACE WEATHER AUTOMATION

Another program you are familiar with is the Automated Weather Observation System (AWOS). This will allow FAA to provide automated weather observations at airports with precision approach aids. Additionally, AWOS will replace current manual observations at some sites for improved productivity. The automatic broadcasting of these observations over voice frequencies will yield obvious safety benefits, and in addition, will permit a lowering of approach minima, as well as an overall reduction in the cost of obtaining weather observations.

ICING

Another weather-associated problem we have addressed is aircraft icing. As you know, Mr. Chairman, FAA has established the "clean aircraft" concept in its regulations. Simply stated this prohibits the takeoff of an aircraft when frost, snow, or ice is adhering to the wings, propellers or control surfaces of the aircraft. Recent wind tunnel and flight tests indicate that frost, snow or ice on wing surfaces can reduce lift by about 30 percent and increase drag by about 40 percent. These effects can, in turn, alter the stability and control of some aircraft and reduce performance. FAA published an Advisory Circular last December to address issues associated with ground de-icing and flight operations following ground operations in icing conditions.

RUNWAY SURFACE TREATMENTS

A related problem is the effect that ice, snow, or slush on runway surfaces have on the braking performance and directional control of aircraft. At the present time, there is no adequate method of establishing a correlation between ground vehicle measurements of runway conditions and aircraft performance. Numerous variables associated with the aircraft, runway surfaces and weather conditions all interact to make this a difficult phenomenon to assess.

Hence, over the past decade, FAA has encouraged and supported the application of runway surface treatments to reduce hydroplaning and improve aircraft braking and directional control on wet and slippery runways. Grooving and porous friction courses are the two primary surface treatments in use. Additionally, information has been disseminated on the design and maintenance of the runway surface to assure effective aircraft tire traction.

RUNWAY MAINTENANCE

Friction measuring equipment is being studied for use in runway maintenance and airport operations.

"Maintenance" refers to keeping the runway pavement surface above a certain friction level and providing good drainage. It is accomplished by conditioning or improving surface texture through removal of contaminants such as rubber deposits and by improving surface texture by physical means. Drainage can be improved by providing surface drainage channels through grooving or porous friction course.

The condition of runways can be monitored for maintenance purposes by taking periodic measurements on dry runways with friction measuring devices that apply water to the pavement at a controlled rate. The result is an indication of the

slipperiness of runways under wet conditions and it is generally accepted that several friction measuring devices are available which can differentiate between good and bad pavement surfaces. Correlation among devices is being determined by extensive testing.

In establishing maintenance criteria a friction value or bench mark is set that is sufficiently high to achieve good runway friction that is economically reasonable to obtain. This will assure safe operations under wet conditions by reducing the potential to hydroplane and will assure that the pavement has an acceptable texture. When the measured friction value is below the recommended bench mark value, correction is made by improving surface texture or removing contaminants.

RUNWAY OPERATIONS

"Operations" refers to taking measurements with friction measurement devices during any change in runway conditions. It requires having equipment on the airport mobilized for immediate use when conditions change and refers to taking measurements under snow and ice conditions. Under operational conditions the object is to obtain a friction reference index and then make this information available to the pilots.

The establishment of operational criteria is a far more complex problem then establishing criteria for runway maintenance

because of the many variables which are involved in relating friction numbers from measuring devices to aircraft braking performance. Current efforts are underway which will attempt to answer many questions which remain with respect to correlating friction devices with aircraft braking performance.

FRICTION CORRELATION STUDIES

In response to a recommendation from the Senate Appropriations Committee, the FAA, in cooperation with NASA, is studying the possibility of obtaining a correlation between aircraft braking performance and runway friction measurement devices. Tests are being performed with transport category jet aircraft and four of the more commonly used friction measuring devices under dry, wet and winter snow conditions at several selected operational runways. During the next two winter seasons, data will be collected on several operational airports to determine if a correlation can be obtained among several friction measuring devices on compacted snow and ice covered runway surfaces.

IMPROVED PAVEMENT

Another aspect of FAA's runway research concerns the characteristics of the pavement itself. The thrust of this program is to develop improved design, maintenance, evaluation, and construction techniques that could result in stronger, more durable, and less expensive airport pavement. Close

examination of these techniques is important because over 50 percent of the total annual Federal Airport Grants-in-Aid Funds have been allocated to airport pavement construction and rehabilitation. Current projections indicate that 53 percent of eligible development costs between 1984-1994 will be needed for airport paving. Moreover, the high cost of petroleum based construction materials, compounded by continued growth of traffic and the increase in runway loads resulting from widebody aircraft, necessitates greater emphasis on developing highly advanced criteria for airport pavement development. These are needed to reduce costs of construction, increase airport capacity, reduce runway "down" time for reconstruction, and meet the high traffic demand forecast for the 1990's.

PAVEMENT OVERLAY THICKNESS CRITERIA

FAA pavement overlay thickness criteria for rigid pavements is over 10 years old. Shortcomings in the current design criteria are evidenced by pavement deterioration prior to expiration of design life. New criteria for rigid pavements were developed in Fiscal Year 1982. Field testing of the new criteria will be completed in Fiscal Year 1983. Work on developing new criteria for overlays of flexible pavements was initiated in Fiscal Year 1983, and the test results will be applied in the development of new overlay design criteria. These activities show great promise for improving the state of the art of pavement design.

IMPACT OF HEAVY JET OPERATIONS ON PAVEMENT LIFE

Work is continuing on a project to determine the impact that high frequency heavy jet operations have on pavement life. Current design standards are based on extrapolations of much lower traffic counts than many airports currently experience. Premature pavement failures have raised questions as to the reliability of extrapolations. An interim report on the assessment of the required thickness in the FAA Advisory Circular will be issued in Fiscal Year 1985. Field tests to validate procedures to determine whether a newly constructed flexible pavement section meets contract requirements will be completed in Fiscal Year 1984.

PAVEMENT DESIGN FOR COLD REGIONS

Cold regions pose unique problems for runways with frost levels and varying pavement load-carrying abilities during the freeze-thaw cycles. We are now gathering data in the behavior of pavement and sub-grade during such freeze-thaw cycles. By next year we expect to finalize a mathematical model to predict the varying characteristics of pavement sections under such conditions. Work is currently being conducted by the U.S. Army Cold Regions Research Engineering Laboratory (CRREL) with a focus on a design guide that can be used for airports in the northern tier of the continental U.S. and Alaska. For the rapid runway rehabilitation effort, the work will be directed

towards restoring pavement serviceability rapidly to reduce runway "down" time.

CRASH-FIRE-RESCUE (CFR)

Our efforts in the area of crash-fire-rescue have been concentrated on developing fire reduction alternatives in the aircraft safety program. We continue to test and evaluate firefighting agents to maintain standards at the state-of-the-art. In Fiscal Year 1985, we plan to review the capabilities of the latest available firefighting equipment. One of the biggest problems in firefighting is getting equipment to accident sites in extremely rough terrain. Existing all-terrain type vehicles may work; however, they could be too slow to be practical. We are continuing to look into this problem.

ALL-WEATHER HELIPORT DESIGN

The FAA, recognizing the rapid growth projected for helicopter operations, recently established a Rotorcraft Project Office to manage the agency's broad activities in this area. This future growth will heavily depend upon the availability of all weather heliports for exploiting the full potential of helicopters. An all-weather capability will enable helicopters to interface with scheduled fixed wing carriers operating out of fully equipped airports, and thereby offer a high level of service

dependability comparable to that which is provided by trunk carriers.

In response to an acknowledged need expressed by the industry for all-weather heliport design standards, FAA work has been initiated to develop a comprehensive set of technical data and information which must be considered during the upgrade of the existing heliport design guide. The following types of information will be considered during the design guide upgrade, and may ultimately be contained in the new all-weather design guide:

-Heliport real estate and obstruction requirements based on Aircraft performance.

-ATC, navigation, landing, communications, surveillance, and advanced weather systems.

-Lighting and Marking.

Additional information will be developed to upgrade VFR heliport design standards/guidelines also. The following areas have been identified at this time:

-Dynamic loading on heliport structures

-Effects of terrain and structure-induced turbulence on heliport operations

-Crash, fire, rescue and fuel handling requirements, particularly for roof-top heliports.

Most of the technology needed to build all-weather heliports exists today; there is a need, however, to identify those methods which are most desirable from a safety and efficiency standpoint. Recognizing the knowledge, experience, and cooperative spirit in the private sector, the FAA Rotorcraft Program Office has established a cooperative program with industry to assist in funding demonstration heliports, through the Airport Improvement Program (AIP); and to provide for the development of design criteria based on experience gained through these demonstration heliports.

OTHER PROJECTS

Further projects FAA has underway include an economical system for marking and lighting of unpaved runways/airports; heliport IFR lighting and marking system evaluation; and obstruction beacon evaluation. In FY 1984 and 1985 we plan work on improved distance to go markers; runway exit identification systems; and high speed exit guidance.

AIRPORT CAPACITY IMPROVEMENTS

FAA and the aviation industry are both concerned about the growing problem of constraints on airport capacity. Several times in the last few years, FAA has called industry experts together to confront the problem and to respond with new and innovative solutions. Last year, we supported an effort by top U.S. aviation experts to come together once again to recommend the most practical measures for increasing capacity at the Nation's major airports, and to reduce the growing problems of congestion and delay. Under the Airport Operators Council International (AOCI) an Aviation Industry Task Force was convened to recommend:

- The most promising, cost-effective improvements or changes, from an operational perspective, that FAA should implement at congested airports.

- Specific changes in terminal area rules, procedures and operations, and airport design and operations that would be required to introduce the recommended improvements.

- The conditions under which the changes described above would be accepted by the public and the users of the aviation system.

- Specific recommendations as to candidate airports for the testing, demonstration, operational trials, and other activities judged essential.

The Task Force produced more than fifty recommendations for action by FAA and by the community itself. FAA has completed and transmitted to the industry a thorough response to the recommendations. The response reflects the Administrator's view of the importance of the Task Force recommendations and FAA's commitment to move out to achieve significant improvements.

The Administrator has a management steering group to assure energetic followup of these activities. FAA is implementing recommendations which do not require further development, and is responding to the policy recommendations. Programs which do require further development or analysis are part of our program planning. These include: validation of a number of airport capacity improvement concepts; work on a highly-capable Traffic Management System which will help improve the efficiency of aircraft flow into and out of our airports; further work on the vexing problem of wake vortex detection and avoidance; efforts to make best use of the Microwave Landing System (MLS) to achieve terminal airspace efficiencies and make better use of

existing runways; and a series of activities relating to airport design and longer-range airport research.

The FAA Administrator has asked the Industry Task Force to continue working with FAA in three specific areas:

- Validation of the capacity improvement concepts (such as reduction of the runway spacing requirement of independent parallel IFR operations, safe application of IFR converging approaches, more efficient dependent runway operations, the best application of short runways at major airports for corporate and commuter aircraft). Further work is needed to agree on the "criteria for success" - the conditions under which the community will find such procedures acceptable.

- To continue with us to try to achieve the operational possibilities of a workable wake vortex detection and avoidance system.

- To continue to highlight airport design issues and critical problems to help focus our programs and assure that there is a clear payoff at the end of any development activity.

The Industry Task Force report, and FAA's response, are not the end of the road. However, we believe that they are important

steps toward solving airport capacity problems which could become even more critical in the future if we do not take steps now to address them. We also believe it is an important example of FAA working closely with industry to try to make needed improvements in our national air transportation system. In this way, we ensure that FAA is addressing the needs of the users of the system.

Mr. Chairman, that concludes my prepared statement. At this time, my associates and I would be pleased to respond to your questions.