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NATIONAL TRANSPORTATION SAFETY BOARD
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Forwarded to:

Honorable Donald D. Engen
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-84-21 through -41

In 1982, accidents near Washington National Airport, 1/ at Boston Logan Airport, 2/ and near New Orleans International Airport 3/ tragically involved many long-standing concerns for the safety of aircraft operations in the airport environment. In response to the significant safety issues raised by the Washington and Boston accidents, the Safety Board conducted a special investigation 4/ to explore the problems of large airplane operations on contaminated 5/ runways. This special investigation focused on information about runway conditions and their relationship to airplane performance, as well as problems in communicating such information among the various elements of the air transportation system.

The Safety Board has completed a safety study of airport certification and operations 6/ to examine in depth two of the three major elements of airport safety--maintenance and operation of airport facilities and airport physical features. The third major element, aircraft operation, is addressed only briefly in this study, because it is an extensive topic which involves several complex facets such as design and performance of aircraft, development and application of operational procedures, reliability and availability of navigational aids, and the accuracy and timeliness of communicating important information in the airport environment. The safety study

1/ Aircraft Accident Report--"Air Florida, Inc., Boeing 737-222, N62AF, Collision with 14th Street Bridge, near Washington National Airport, Washington, D.C., January 13, 1982" (NTSB-AAR-82-8).

2/ Aircraft Accident Report--"World Airways, Inc., Flight 30H, McDonnell Douglas DC-10-30, Boston Logan International Airport, Boston, Massachusetts, January 23, 1982" (NTSB-AAR-82-15).

3/ Aircraft Accident Report--"Pan American World Airways, Inc., Clipper 759, Boeing 727-235, N4737, New Orleans International Airport, Kenner, Louisiana, July 9, 1982" (NTSB-AAR-83-2).

4/ Special Investigation Report--"Large Airplane Operation on Contaminated Runways" (NTSB-SIR-83-2).

5/ "Contaminated" as used in the referenced report and in this report means that ice, snow, slush, water, or rubber deposits have accumulated on the runway to the extent that airplane performance is affected measurably.

6/ For more detailed information read, Safety Study—"Airport Certification and Operations" (NTSB/SS-84/02).

examines the background andscope of 14 CFR Part 139 as it concerns the maintenance and operation of airport facilities; the Federal Aviation Administration's (FAA) administration of the airport certification program; the results of certification activities; airport physical limitations; and other related safety considerations.

Selected for the study were airports that would permit comparison of airport certification and surveillance methods employed by different FAA regional offices as well as observation of operations at some physically limited older facilities and some less constrained newer airports located in the same geographical area. Parameters considered included passenger enplanements, runway length, safety area characteristics, dates of construction or modification, accident and incident histories, and approach area characteristics. All but one of the airports chosen were selected from among the 36 large hub airports for 1981, which handle a large number of total aircraft departures, serve the largest volume of revenue passengers, and are located in geographical areas served by more than one certificated airport. After weighing these considerations, obtaining the viewpoints of representatives of the Air Line Pilots Association, the Airport Operators Council International, and the American Association of Airport Executives, a group of 14 airports in 7 different FAA regions was chosen, including 5 airport pairs. The airports chosen for study were: Washington National, Dulles International, Kennedy International, New York LaGuardia, Los Angeles International, Burbank-Glendale-Pasadena, Houston Intercontinental, Houston Hobby, Chicago O'Hare, Chicago Midway, San Diego Lindbergh, Denver Stapleton, Boston Logan, and Ft. Lauderdale-Hollywood, Florida.

The principal process used by the FAA to implement the airport certification program is the facility inspection. Airport inspections are the basis for determining if an airport's facilities, maintenance, and operations meet the regulatory requirements of Part 139. FAA Order 5280.5 contains policy guidance and standard procedures for FAA personnel to conduct the certification program.

The Safety Board's facility checks confirmed the accuracy of FAA inspection findings for pavement area conditions and marking and lighting runways, thresholds, and taxiways at all but one of the study airports. Also, FAA inspection records regarding protection of navigational aids, bird hazard reduction, construction area marking, and snow removal were found to be accurate, and no serious deficiencies were noted in these areas. Although the Board found that the airports had several different methods of satisfying these requirements, each seemed to be appropriate for the local conditions, and responsible personnel were very knowledgeable about the effectiveness of procedures. However, the Board also found that vagueness of certain FAA compliance criteria and regional disagreement on their application has resulted in some airports having far better methods than others for control of ground vehicle operations, public protection and animal control, fuel dispensing and storage, and runway surface condition assessment.

No unsatisfactory trends in ground vehicle operations were reported in recent FAA inspections of the study airports, but the Safety Board's survey found distinct differences in the degree of airport management control over ground vehicle operations and conditions at the various airports. Some airports required annual inspections of all vehicles driven in the aircraft parking area, and some airports maintained strict driver standards through the suspension of airport operations area driving privileges in cases of poor performance. At airports where there was less vigorous control of ground vehicle operations, the Board found more recorded vehicle and aircraft collisions for the prior year than at the other airports.

FAA annual inspections of public protection measures at the study airports usually cited problems such as open gates or doors leading to the airport operations area and occasionally identified situations where the airport operations area could be entered by climbing over articles stored near a fence. The Safety Board found some uncertainty among certification inspectors about what an airport should do to insure public protection. Some of the confusion results from ambiguities in the FAA regulations. Title 14 CFR 139.65, which requires a certificated airport to have ". . . appropriate safeguards against inadvertent entry of persons or large domestic animals onto any airport operations area," also states that airports complying with 14 CFR Part 107--Airport Security are acceptable under 14 CFR Part 139. But Part 107, which is intended to provide protection against acts of criminal violence and air piracy, requires airport operations area security to prevent ". . . entry of unauthorized persons and ground vehicles." Apparently, inspectors are not sure whether airport public protection measures should be required to prevent "inadvertent entry" to the airport operations area (14 CFR 139.65) or ". . . to control penetration of an [airport operations area] by an unauthorized person" (14 CFR 107.23). Also, 14 CFR 139.65 specifically requires safeguards against inadvertent entry of "large domestic animals" to the airport operations area; however there is no requirement to prevent entry of wild animals, nor is there any definition of a "large domestic animal."

At all study airports except Dulles International and Burbank-Glendale-Pasadena, the Safety Board saw fueling service discrepancies which included leaking fuel trucks, fuel trucks without fire extinguishers, trucks on which the fuel type was not easily identified, fueling being performed without grounding, and fueling being performed without securing (chocking) the wheels of the truck. A review of FAA annual inspection records for these airports did not show any similar observations by FAA inspectors. Records at one regional office indicated that inspectors were uncertain about what bonding and grounding procedures should be considered acceptable during fueling operations.

Extensive comments on prior inspection reports about fuel handling and storage were found at only one of the regional offices surveyed. While fuel storage inspection is an annual requirement, the Safety Board found that many of the FAA certification inspectors have no experience or formal training in the operation of fuel storage facilities, nor do they have standard guidelines to use during the inspection process. The Board found this apparent lack of surveillance capability to be disturbing.

The Safety Board also found that a fundamental disagreement existed between airport operators and the FAA regarding an airport's responsibilities under 14 CFR 139.51(b) which requires that "the airport (or its tenant) as the fueling agent have an adequate number of trained personnel and procedures to safely dispense aviation fuel." Airport managers said that holding the certificated airport responsible for tenant fueling agent operations is unfair and that adequate surveillance of fueling operations would impose a severe financial burden on the airport. The airport managers further argued that they are not held responsible for the quality of airplane maintenance or flight training of their fixed base operations (FBO) or for certificating those individuals conducting such services and that they did not understand why one segment of an FBO's services (fueling) was being singled out. Many airport managers believed that fuelers should be licensed by the FAA as are pilots and mechanics. Since the responsibility for aviation safety is shared by pilots, mechanics, and fuelers, the FAA should ensure that a minimum level of competency for fuelers is required by instituting a certification program.

The Safety Board's concern that the FAA's inspection personnel had too limited knowledge of storage facilities led to study team visits of 30 fuel service facilities for the purpose of identifying problems. Only two of the facilities visited administered a prehire

test for aptitude. About 75 percent of the fuel service facilities hired people "off the street" for refueling positions. The remaining facilities elevated personnel to a refueling position from within company ranks. Roughly 90 percent of the facilities that hired people "off the street" preferred that the prospective employee have some aviation and/or fueling experience; however, this was not mandatory.

Each facility required a new employee to read company safety, operations, and quality control manuals and attest to having done so by signing a statement. This was the only classroom or self-study training for new refueling employees at 20 percent of the fuel service facilities visited. The remaining 80 percent had tests on refueling procedures and some audiovisual presentations. Managers of all of the facilities visited said that they reviewed the use of fire extinguishers with new hires as part of the employee's training. However, only five facilities provided new hires with the "hands on" practical use of a fire extinguisher. Only four facilities had some type of recurrent training for refueling personnel, which varied from an oral question-and-answer period to an observation and critique of the refueler's performance.

Managers of all of the fuel service facilities visited said that they reviewed safe airport driving practices with new hires. However, only two of the facilities required the employee to pass a drivers test; one of these facilities was located on an airport that required new airport employees to pass a driving test administered by airport authorities.

The majority of the fuel service facilities used old refueling vehicles--in some cases nearly 20 years old--but most of the vehicles appeared to be in good mechanical condition. Managers said that vehicle maintenance was good. All of the facilities required a condition inspection of their refueling vehicles, and nearly every facility required that the vehicle inspection be performed with a company inspection checklist tailored to the refueling vehicles. However, only one facility published a minimum requirement checklist which provided specific guidelines to be used in deciding whether to accept or reject a vehicle.

Most of the fuel storage facilities at the 14 study airports were old--in some cases over 40 years old--and settling of storage tanks over long periods has resulted in leakage into the ground at some facilities. While not considered a fire or explosion hazard, leakage into the ground is a serious environmental concern. When these facilities were built, they were located in remote sections of the airport. Through the years, both on- and off-airport construction has caused the distance buffer between the storage facilities and highly traversed areas to be diminished greatly. Washington National, Houston Hobby, and Fort Lauderdale-Hollywood are prime examples of this encroachment. Heavily used public roadways lie just a few feet away from the fuel storage facilities on these airports.

Every fuel storage facility had experienced a fuel spill. In some cases the spill amounted to several thousand gallons. Most of these larger spills were caused either by defective valves or fittings or by the failure of overflow warning devices to alert fueling personnel. About 50 percent of the facilities periodically checked their overfill warning systems. However, nearly all of the fuel service facility managers interviewed indicated that mechanical sensing systems were not very accurate or reliable, and checking the operation of these mechanical systems was difficult or in some cases impossible. For example, one facility the Safety Board visited had a high-level alarm system which was not equipped with a means to check its operation. Fuel spills have occurred at this facility because the mechanical sensing system failed to activate and thus alert personnel to halt the fueling operation. At another facility the mechanical high-level overfill sensor failed its last alarm test.

The airport certification regulations require that firefighting and rescue services be available at certificated airports in accordance with index standards established in Part 139. Although these services will not prevent accidents, they may significantly increase the survivability of certain types of crashes which occur within reach of the emergency equipment. In the postcertification period (1973 through 1981), 53 percent of the air carrier accidents occurred on the airport, and 18 percent of those involved a fire. While the number of air carrier accidents occurring on airports decreased 50 percent in the postcertification period, the 138 postcertification, on-airport air carrier accidents indicated a continuing need for emergency services at airports.

The Safety Board's review of FAA annual inspections of crash-fire-rescue equipment and services and emergency plans for the study airports showed that all airports complied with the requirements of Part 139. The onsite survey of emergency capabilities showed a wide variation in the equipment, resources, and procedures found at the study airports.

Chicago Midway met the minimum requirements; all other study airports exceeded the minimum vehicle requirements of the regulation. The average number of vehicles at airports having no structural firefighting responsibility was 5.6, which exceeded minimum requirements by 87 percent. The minimum staffing requirements of 14 CFR 139.49(h) call for: ". . . sufficiently qualified personnel to insure at least 85 percent of the required maximum agent discharge rate of firefighting equipment." Since most firefighting equipment has a turret system which enables the operator to meet the 85 percent discharge requirements, it is theoretically possible that the regulatory requirement could be met with as few as three people--one person who could drive the vehicle and then operate the turret system for each of the three vehicles. However, the staffing of crash-fire-rescue services at all study airports exceeded this theoretical minimum.

Part 139 specifies minimum water quantity requirements for firefighting. The National Fire Protection Association (NFPA) and the International Civil Aviation Organization (ICAO), of which the United States is a member, have published guidelines for water and dry chemical agent quantity similar to those of Part 139. ICAO and NFPA quantity recommendations exceed the Part 139 minimum requirements. Beyond the minimal requirements prescribed by Part 139, the FAA, in Advisory Circular (AC) 150/5210-6B--Aircraft Fire and Rescue Facilities and Extinguishing Agents, dated January 26, 1973, has described recommended levels of protection which are comparable to ICAO standards. The study airports not only exceeded FAA minimum standards for water quantity, they all exceeded the more demanding NFPA guidelines and ICAO member requirements. If the degree to which study airports voluntarily exceeded the minimum requirements for manpower, equipment, and extinguishing agents of Part 139 is typical, then the adequacy of the minimum levels established by the FAA appear to be questionable, especially since the FAA advisory publication recommends higher levels based on research, test data, and experience.

Title 14 CFR 139.49(i) requires that crash-fire-rescue personnel be ". . .familiar with the operation of the firefighting and rescue equipment and understand the basic principles of firefighting and rescue techniques." The FAA's AC 139.49-1, AC 150/5210-12, and AC 150/5280-1 list several topics for crash-fire-rescue personnel training. However, these AC's are only advisory, and they are subject to interpretation. Most of the study airports had conducted emergency drills; some alternated full-scale drills with table-top simulation exercises on an "every-other-year" basis. Only table-top simulations were conducted at a few airports because managers were concerned that full-scale drills caused local traffic congestion and, in their opinion, wasted manpower.

The Safety Board believes that full-scale exercises of emergency plans usually reveal problems which would not be apparent in a table-top demonstration. The Board found that, in general, FAA inspectors were encouraging the study airports to conduct live drills and full-scale emergency exercises. The weakest area of training the Safety Board observed was in familiarization with new airplanes. None of the crash-fire-rescue units at the study airports had training diagrams of the DC-9-80, or the Boeing 757 or 767.

Title 14 CFR 139.49(h) requires that firefighting and rescue personnel be "appropriately clothed." Although the FAA highly recommends the proximity suit for aircraft firefighting, there is nothing in Part 139 or FAA Order 5280.5 to preclude the use of less effective protective clothing to comply with 14 CFR 139.49(h). All of the protective clothing observed at the study airports was the aluminized fabric type, although many of the suits differed in construction and in fabric weight. There were no standards available to inspectors for judging the adequacy of various types of proximity suits.

The FAA convened a public meeting on July 14, 1983, to discuss updating and amending Part 139, in light of its experience with the certification program, as well as Safety Board and industry recommendations, and the results of its own studies. The subjects proposed for discussion by the FAA included emergency plans, snow removal, safety areas, bird hazard management, fueling operations, marking and lighting of runways and taxiways, crash-fire-rescue index requirements, and crash-fire-rescue training. The FAA also has proposed specific standards for training requirements such as those recommended by the NFPA, which should eliminate some of the variations in crash-fire-rescue training observed at the study airports. The State of Georgia has enacted legislation to require firefighters to successfully complete training in accordance with NFPA Standards 1001 and 1003. These standards specify a method to evaluate a training curriculum for crash-fire-rescue personnel. The Georgia program is viewed by some as a prototype which could be used as a model for other programs. However, an FAA official observed that it is impractical and inequitable to impose "across the board" training requirements on both large and small airports. Although some differences in the training syllabus for crash-fire-rescue personnel would seem to be appropriate at larger (index C, D, and E) and smaller (index A and B) airports, the Safety Board believes that 14 CFR Part 139 must specify a minimum acceptable level of training for all certificated airports. Crash-fire-rescue personnel should be equally well prepared at all airports to handle aircraft emergencies.

The most controversial proposal introduced by the FAA at the public meeting called for lowering crash-fire-rescue vehicle requirements at index B airports from two vehicles to one, and substituting an unspecified level of crash-fire-rescue protection, which would be established in individual negotiations between the FAA and airports, for the present index A minimum requirements of one vehicle with a 3-minute response time. This proposal emanated from an FAA-commissioned study 7/ of crash-fire-rescue costs and benefits, which recommended eliminating crash-fire-rescue requirements at lower index airports because of low benefits accrued in proportion to costs. The FAA has received comments from organizations such as the NFPA and the Air Line Pilots Association (ALPA) critical of the study methods and findings. The Safety Board is concerned that this proposal could lead to a safety reduction at lower indexed airports, which account for more than half of all the certificated airports and enplane about 3 percent of all passengers each year. Theoretically, under existing regulations andthe proposal advanced

7/ "Airport Crash, Fire, and Rescue: Policy Alternatives Suitable for Further Analysis," H. H. Aerospace Design Co., May 1982, DOT/FAA/AS/82-1.

for discussion, large jet transport aircraft could average four departures per day at A or B airports and be virtually unprotected by crash-fire-rescue equipment. The Board views with concern any reduction in crash-fire-rescue capability and intends to carefully review any proposed rule change in this regard at such time as a Notice of Proposed Rulemaking (NPRM) to amend Part 139 is issued.

As the Safety Board staff visits to the seven FAA regional offices and the 14 study airports within the regions progressed, the Board was able to construct a qualitative and quantitative picture of the methods used to administer certification program activities. Interregional annual inspection differences and differences between FAA annual inspection records and the Board's observations already have been documented. In cases where regulations were found to be vague or guidance materials highly subjective, the differences were readily discernible. However, the Board found also that other qualitative factors such as the inspector's professional background and distinct styles of management appeared to influence regional surveillance activities.

The operation and maintenance of the study airports required the attention of personnel with diverse backgrounds and experience in areas such as civil engineering, electrical engineering, firefighting and rescue, public protection and emergency planning, and aircraft operational requirements. Most FAA certification inspectors, in the seven regions visited, had in-depth experience in one of the engineering disciplines, and many were also pilots. The inspectors had to augment their professional qualifications and experience in unfamiliar areas through agency training and on-the-job experience. In each of the regions, the Board observed in annual inspection records of study airports that inspectors naturally tended to emphasize the areas corresponding to their background and experience. To overcome this tendency, five regions recently established a form of inspection assignment rotation among inspectors.

Some regional offices appeared to have developed a degree of expertise in certain aspects of airport operations which was acknowledged by other regions surveyed. For example, fuel storage and dispensing expertise was found in one region, crash-fire-rescue expertise in another, and bird hazard reduction expertise in yet another. Regional managers and inspectors believed that the expertise evolved either from the need to deal with a particular problem related to local conditions or geography common to many airports within a region, or from individual inspector expertise or interest in an area such as crash-fire-rescue.

Many of the region-to-region differences in the administration of the airport certification program, for which justification is not readily apparent, could be reconciled through an organizational unit with the authority to resolve conflicting viewpoints. An organizational entity for airport certification, patterned after existing FAA Aircraft Certification Directorates, could draw upon regionally dispersed technical expertise to provide the best advice for development and implementation of uniform, detailed regulatory compliance criteria.

The tragic consequences of the Air Florida accident near Washington National, the World Airways accident at Boston, and the Pan American accident at Kenner, Louisiana, brought forth renewed expressions of concern for the safety of people residing, working, or traveling near airports, as well as for the safety of air travelers. The adequacy of airport safety margins has been questioned, especially at older, smaller airports originally designed and built to serve airplanes powered by reciprocating engines, which typically required less runway length than the first generation of commercial turbojet airplanes. The Safety Board analyzed aircraft accidents and incidents in which airport physical limitations may have been involved to assess the significance of such limitations. Several

of the 14 study airports were selected because they provided an opportunity to observe various physical constraints imposed by topographical features or community growth and their influence on operations at the airport.

As the Safety Board found in the case of all types of air carrier accidents, the number of air carrier undershoot, overshoot, and veer off accidents decreased substantially in the postcertification period (1973 through 1981). The accident rates (number of accidents occurring in the United States per million air carrier operations) in the 1973 through 1981 period decreased from the rates of the prior 9 years by about 60 percent for undershoots, by 51 percent for overshoots, and by 66 percent for veer offs. In relation to all air carrier accidents which occurred in the United States for the 1973 through 1981 period, undershoots accounted for 2.4 percent, overshoots for 3.2 percent, and veer offs for 3.6 percent. Almost 10 percent of the air carrier accidents from 1973 through 1981 either involved or could have involved aircraft encroachment on areas adjacent to runways. Twenty out of 29 undershoots and overshoots in the postcertification period involved substantial damage, and two of the overshoots and two of the undershoots resulted in fatalities.

Runway length, one of the primary indicators of physical airport constraints, appeared to have little direct relationship to the occurrence of undershoots. Factors such as the presence of some form of precipitation and availability of flight path guidance were of more significance in undershoot accidents. However, as expected, overshoots were related to runway length as well as weather conditions conducive to degrading the runway surface stopping capability. Seventy-four percent of the air carrier overshoot accidents involving narrow-bodied, two- or three-engine turbojets between 1964 and 1981 occurred on runways shorter than 8,000 feet, and about half of all air carrier overshoots between 1964 and 1981 occurred in inclement weather (rain, sleet, or snow). Safety Board records also show that flightcrew operational errors were cited in nearly all encroachment accidents where causal or contributing factors were assigned. Although it is more likely that overshoots will occur on shorter runways, the Safety Board found that 11 percent of the narrow-bodied, two- or three-engine turbojet overshoots occurred on runways that were 9,000 feet or longer.

In the Safety Board's special investigation report of operations on contaminated runways, 8/ the Board discussed the runway length safety margins provided by existing FAA certification and operational standards and concluded that the FAA should adopt rules which will provide adequate runway length safety margins in relation to existing conditions. Increasing the runway length required for operations from contaminated surfaces, which could result in the need to reduce airplane operating weight at airports with shorter runways in order to avoid exceeding the runway length available, is one method of compensating for degraded stopping capability and reducing the potential for an overrun.

Although adequate runway length safety margins for contaminated runway conditions would reduce overrun possibilities, the Safety Board's survey of encroachment accidents also showed that overruns have occurred on runways of 9,000 feet or longer and that undershoots may occur on any length runway. Therefore, the Safety Board investigated other measures, such as safety areas and frangible structures, which can mitigate the consequences of encroachment-type accidents.

8/ Special Investigation Report--"Large Airplane Operation on Contaminated Runways" (NTSB-SIR-83-2).

In visits to the 14 study airports, the Safety Board staff found that the dimensions of safety areas were generally acceptable in the areas along the sides of the runways. At the constrained airports, such as New York LaGuardia, Chicago Midway, Burbank-Glendale-Pasadena, San Diego Lindbergh, Houston Hobby, Boston Logan, and Washington National, the safety areas at the ends of the runways were marginal or nonexistent, and there were no extended runway safety areas at these airports. There were extended runway safety areas at many of the larger airports, but even at the larger airports some safety areas were smaller in size than recommended by FAA design guidelines of AC 150/5335-4. However, because of the length of the runways at these airports, an extra margin normally is available to prevent an overrun.

The continual problem of encroachment by the surrounding community, which is the result of geographical barriers and conflicting interests and improper land use planning, renders unlikely any substantial increase in the size of runway end safety areas at most airports. However, at Boston Logan, the Safety Board was introduced to a possible alternative to extended runway safety areas--a unique plan which analyzed the feasibility of constructing inclined safety areas (ISA) gradually sloping downward at the ends of runways bordered by water. The concept, as described by the airport engineer and shown in a scale model, provides a transitional surface from the runway elevation to the water surface. The ISA would be surfaced with loose gravel or crushed stone, which provides more effective and safe arresting of aircraft than a conventional safety area. The use of an adaptation of the ISA at airports with limited hard-surface safety areas could significantly improve aircraft stopping capability in these areas, without having to increase their size. This concept merits further consideration by the FAA.

All of the airways facilities personnel at the airports visited indicated support for the use of frangible structures. Some airports, however, cannot readily incorporate frangible structures. New York LaGuardia, for example, is geographically bordered by water along several runway approach corridors which precludes the use of frangible approach light structures according to the FAA's program manager for low impact resistance structures (LIRS). He states that difficulties associated with designing frangible support structures for use in water are so complex that design criteria have not been developed by the FAA or the ICAO. In present water installations, approach light bars are attached to the submerged support structures with frangible fittings, but the support structures are not frangible. Factors which complicate attempts to design submerged support structures meeting low impact resistance criteria include wave frequency and characteristics, ice pressure, and water depth variations caused by tides. It is clear that it will be a difficult task to develop design criteria for support structures strong enough to withstand the effects of water-related forces yet having low impact resistance, but additional research to resolve the problem certainly merits conditions.

Natural and man-made objects may have a significant effect on air navigation and aircraft maneuvering, particularly during landing and takeoff operations. An airport which initially may have few limitations can become limited severely in its operations as man-made objects encroach upon the boundaries, or as natural objects, such as trees, grow in areas where aircraft approach or depart the airport. Title 14 CFR 139.61 states that the airport operator is responsible for insuring that obstructions within the confines of the airport boundaries are clearly marked and lighted. The regulation does not address objects outside the airport boundaries which have been determined to be obstructions.

The issues of land use and obstructive structures are complex matters involving conflicting interests. It is obvious that airport operators cannot exercise direct control over obstructions off the airport. Although Part 77 requires that the FAA be notified of proposed construction which might affect the airspace around an airport, the need for the FAA to use a criminal procedure to enforce this provision is a serious limitation. This topic was discussed in an FAA review in 1972 of the need ". . . to strengthen the agency's regulations and their application to all towers and other tall structures." The FAA decided that it would be beneficial to seek a change in the FAA Act of 1958 to permit a levy of a civil penalty in a case where a sponsor fails to give notice of construction as required by Part 77, rather than the criminal penalty in the Act. However, no known further action has been taken or is contemplated to change the law.

Although the Safety Board's study was confined to certificated air carrier airports, the review of airport obstruction information indicated that a more serious problem may exist at smaller, utility airports. In 1975, two accidents at such airports in which aircraft struck trees during night landing approaches prompted the Safety Board to issue Safety Recommendations A-75-81 and -82 on November 6, 1975, calling for identification of significant obstructions at public-use airports and the dissemination of such information to pilots. The airports that have precision and nonprecision instrument approaches have an increased degree of protection from obstacles and obstructions because of the approach surface standards that must be considered in approving the installation of these types of approach procedures. Utility airports that do not have instrument approach procedures to their runways do not have as high a degree of protection. The approach surface for these visual approach runways is at a slope of 20:1 instead of the 50:1 slope for instrument runways.

In response to Safety Recommendations A-75-81 and -82, the FAA instituted the Airport Safety Data Program in 1981. Under this program, governed by FAA Order 5010.4, the inspection of public-use airports, through increased participation of State aviation organizations and private contractors, has improved collection and publication of airport obstruction data. However, a Safety Board review of the obstruction data provided in the FAA's Airport/Facility Directory (AFD) found it to be of limited value for operational purposes. For example, at many utility airports objects of a permanent nature are listed in the AFD if the objects lie within the boundaries of Part 77 approach surfaces; however, descriptive data about the size or location of the object relative to the runway end or centerline are not reported. Since this type of information is collected under the Airport Safety Data Program, the FAA should publish the descriptive data about significant objects as an approach or departure planning aid for pilots.

The Safety Board also noted that the lighting of obstructions is not consistently reported in the AFD and that there is no information about changes to operational procedures which may be dictated by the presence of an obstruction within the Part 77 approach surface boundaries. Since applicants for a pilot's license are not tested for knowledge of information in Part 77 or regarding information pertaining to hazards or obstructions in any other aeronautical publications, the Board believes that incorporating some explanatory material in the AFD regarding this subject would be beneficial.

Because navigation equipment plays an important part in determining an airport's operational flexibility and because the reliability of navigational aids (NAVAID's) could have safety implications, the study team surveyed airways facility staff at all the study airports to learn about problem areas. All of the airports visited had some problems with their NAVAID's. Most of the problems were associated with the age of the NAVAID equipment.

This was especially true of the tube-type instrument landing systems (ILS's). The FAA has an ongoing program to replace vacuum tube-type ILS's with solid-state equipment. At the end of fiscal year 1983, approximately two-thirds of the ILS's in this country had been retrofitted, according to airways facility staff at FAA headquarters.

The FAA has not had an active hiring program for the airways facility sector in several years. FAA headquarters management believes that the hiring and training of new personnel is unwarranted because the FAA's current Navaid Modernization Program will eliminate the need to have the present number of airways facility technical personnel. However, many airways facility personnel expressed concern over the FAA's ability to implement and complete this modernization program in a timely manner; they were especially concerned with their ability to adequately maintain the older NAVAID systems during the period of building, testing, and commissioning of the new systems. For example, Houston Hobby airway facility personnel said that a majority of their technicians would be eligible to retire within the next 5 to 8 years. Only three of their radar technicians will remain in 6 years, and it takes at least 3 years to fully train a radar technician. Boston Logan airway facility personnel said that about 46 percent of their technicians would be eligible for retirement by 1989. Boston Logan currently has no trainees, and it reported that 3 to 4 years are needed to bring a "new hire" up to "journeyman" level. Washington National airway facility personnel said that 11 out of 28 technicians would be eligible to retire within the next 5 years.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 139.65, "Public Protection," to require safeguards against unauthorized entry of persons and inadvertent entry of large animals onto any airport operations area. (Class II, Priority Action) (A-84-21)
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> Revise FAA Order 5280.5, "Public Protection," to establish criteria for acceptable types of fencing and support structure and a policy for gate security for the air operations area at certificated airports. (Class II, Priority Action) (A-84-22)
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> Revise FAA Order 5280.5, "Ground Vehicles," to include specific criteria for determining the adequacy of ground vehicle control, such as the number of ground vehicle accidents each year, disciplinary actions taken in accident cases, the number of repeat offenders, and an annual accident rate. (Class II, Priority Action) (A-84-23)
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> Establish an airport directorate within the FAA, similar to aircraft certification directorates, having technical resources and authority to provide leadership for the airport certification program and consistent application of 14 CFR Part 139. (Class III, Longer-Term Action) (A-84-24)
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> Certificate fueling personnel at certificated airports. (Class III, Longer-Term Action) (A-84-25)
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> Establish designated fueler certification examiners to ensure a uniform standard for fueling training, knowledge, and competence at certificated airports. (Class III, Longer-Term Action) (A-84-26)

As an interim measure until a program for certificating fueling personnel can be established, revise the compliance criteria applicable to certificated airports in FAA Order 5280.5, "Handling and Storage of Hazardous Material," to contain specific standards for initial and recurrent training of fueling personnel, which address methods of assuring fuel quality, fire prevention, vehicle inspection and operation, proper fueling techniques, and knowledge of airport operating rules. (Class II, Priority Action) (A-84-27)

Revise the compliance criteria in FAA Order 5280.5, "Handling and Storage of Hazardous Material," to incorporate detailed procedures for fuel storage area inspections and specific facility acceptability criteria. (Class II, Priority Action) (A-84-28)

Require certificated airports to include fuel storage and dispensing facilities in the selfinspection program prescribed in 14 CFR 139.57 and 139.91 and specify the items, including tank overfill warning devices, which must be checked and approved by airport inspection staff. (Class II, Priority Action) (A-84-29)

Adopt design and construction standards for fuel storage area site selection and safety devices at airport fuel storage facilities to be applied uniformly to new airports receiving Federal funds or to currently certificated airports when storage facilities are relocated. (Class III, Longer-Term Action) (A-84-30)

Revise 14 CFR 139.49(b) crash-fire-rescue index requirements for water and extinguishing agents to include the recommendations for extinguishing agents specified by the International Civil Aviation Organization or as published in FAA Advisory Circular 150/5210-6B. (Class II, Priority Action) (A-84-31)

Revise 14 CFR 139.49(h) to require a minimum of two firefighters per vehicle and to specifically define minimum standards for training of crash-fire-rescue personnel. (Class II, Priority Action) (A-84-32)

Revise FAA Order 5280.5, "Fire Fighting and Rescue," to prescribe equipment equal to or better than the proximity suit with lining that is recommended in paragraph 154d, as acceptable for aircraft firefighting and to contain standards by which the adequacy of this protective clothing can be determined for the most extreme exposure conditions which can be safely encountered. (Class II, Priority Action) (A-84-33)

Amend 14 CFR 139.55 to require a full-scale demonstration of certificated airport emergency plans and procedures at least once every 2 years, and to require an annual validation of notification arrangements and coordination agreements with participating parties. (Class II, Priority Action) (A-84-34)

Incorporate in any 14 CFR Part 139 rulemaking proposal calling for a reduction in crash-fire-rescue capability at index A and B airports a list of affected airports, a list of types and schedules of air carrier aircraft serving these airports, and a description of the effect of such a reduction on the firefighting posture of the airports. (Class II, Priority Action) (A-84-35)

Initiate research and development activities to establish the feasibility of submerged low-impact resistance support structures for airport facilities, and promulgate a design standard, if such structures are found to be practical. (Class II, Priority Action) (A-84-36)

Initiate research and development activities to establish the feasibility of soft-ground aircraft arresting systems and promulgate a design standard, if the systems are found to be practical. (Class III, Longer-Term Action) (A-84-37)

Where elimination of obstructions that have a significant adverse effect on aircraft operation at public-use airports is not feasible, publish detailed data on the location of the obstructions and corresponding operational procedures or flight restrictions in the Airport/Facility Directory. (Class II, Priority Action) (A-84-38)

Seek statutory authority to prescribe civil penalties for sponsors of proposed construction who fail to comply with the notification requirements of Subpart B of 14 CFR Part 77. (Class II, Priority Action) (A-84-39)

Incorporate into pilot training programs and appropriate aeronautical publications sufficient information on the Airport Safety Data Program to familiarize airmen with the criteria in 14 CFR Part 77 used to determine whether an object is an obstruction to air navigation that might adversely affect aircraft operations. (Class III, Longer-Term Action) (A-84-40)

Provide continuing maintenance services for existing navigational facilities during the period of transition to the new generation of equipment. (Class II, Priority Action) (A-84-41)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, ENGEN, and GROSE, Members, concurred in these recommendations.

By: Jim Burnett
Chairman