



## The Airport Side of Runway Incursions

*Aircraft are not the only conveyances involved in unauthorized entry to the sacrosanct landing/takeoff portions of an airport — ground vehicles must be operated with equal caution to help reduce a preventable hazard.*

—  
by  
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Are runway incursions on the rise? Do airports and ground support personnel contribute to the problems and how? Are pilots and air traffic controllers also involved?

What is the U.S. Federal Aviation Administration doing about them? These and other questions are addressed in "Reducing Runway Incursions: An FAA Report" issued April 1990.

Runway incursions, an insidious problem that simply refuses to go away, stimulated the U.S. Federal Aviation Administration (FAA) to embark upon a study of the total operational environment to include air traffic controllers, pilots, airports and support personnel. A runway incursion team, chaired by the FAA's assistant administrator for aviation safety, included representatives of the associate administrator for air traffic, the office of airport safety and

standards, the office of flight standards, the advanced system design service, the U.S. National Transportation

Safety Board (NTSB), The Mitre Corp. and Briere Associates Inc.

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The FAA defines a runway incursion as "an occurrence at an airport involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in loss of separation with an aircraft taking off, intending to take off, landing, or intending to land." Each occurrence of these incidents represents a potentially catastrophic situation.

Official FAA statistics covering the years 1986 through 1989 show approximately 325 incidents in 1986, 400 in 1987, 190 in 1988 and 210 in 1989. Those statistics were taken from the National Airspace Information Monitoring System which tracks near mid-

air collisions, operational errors, pilot deviations and runway incursions. (Figure 1)

While the numbers show a decline in 1988-89 over 1986-87, the FAA is unable to specify reasons and does not know whether the reduction in incidents reflects changes in awareness, behavior or circumstances that would continue this trend.

The FAA study divides causal factors into three categories: controller-related factors, pilot-related factors and ground vehicle operator-related factors. There is some commonality to the factors such as forgetfulness, failure to understand clearances, inadequate scanning and inadequate or faulty position awareness.

While this digest of the FAA study will focus primarily on airport ground related problems, it is important to understand that runway incursions may result from a combination of factors that involve ground vehicle operators, air traffic controllers and pilots.

The FAA study concedes that previous statistics relating to ground vehicle operator-related factors are highly suspect. The reporting requirements were changed by FAA Notice 7210.343, issued February 22, 1989, to formally include this type of incident in the runway incursion data. Nevertheless, the agency was able to make generalized observations about this type of incident.

Causes vary with the kind of vehicle involved and can be divided into three categories: those authorized to be on the movement area; those authorized to be on the airfield but not on the movement area; and those not authorized to be on the airfield.

The movement area is the surface area on which a vehicle or aircraft must have permission from the air traffic control tower to operate and usually includes the runways and associated taxiways. These vehicles may include those involved in airport operations, airport and navigation aid maintenance, aircraft rescue and fire fighting, security and snow removal. Generally, the operators are familiar with the airfield environment and know about radio communications procedures. For these types of vehicles, the principal causes of runway incursions are:

1. Failure to understand clearances and instructions.

Although the FAA study does not elaborate on this problem for ground vehicle operators, it does go into more detail about pilots who have similar problems. For pilots, runway incursions during the taxi phase produce an overwhelming number of incidents from misunderstanding clearances and instructions. By changing appropriate words, pilots and vehicle drivers may be grouped together as follows:

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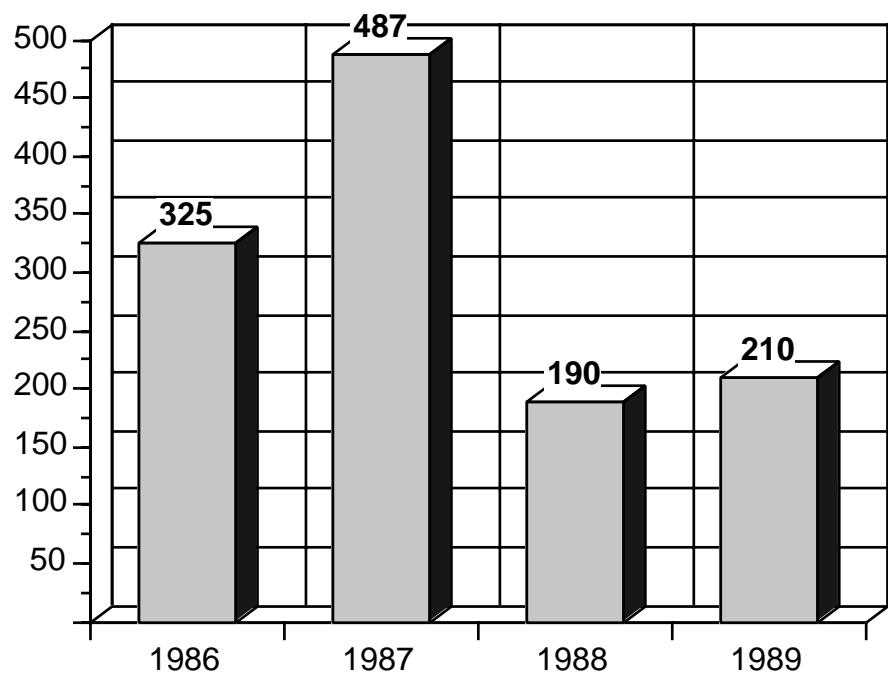
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- Difficulty in interpreting clearances at airports with complex configurations.
- Difficulty in actually hearing messages via radio. Pilots (drivers) at times hear taxiway designators or runway numbers incorrectly and they sometimes accept a clearance for another aircraft (vehicle), especially when the call signs are similar.
- The use of non-standard phraseology.

- Pilot (driver) complacency. Distraction or pre-occupation can cause pilots (drivers) to respond to clearances they expect, rather than to ones they actually receive. This can also result from well-established habits at a frequently used airport.

**Annual Number of Runway Incursions**



**Figure 1**

2. Forgetfulness. Again, what applies to pilots can be interpolated to apply to vehicle drivers. Pilots (drivers) sometimes forget to request a clearance when one is required and just as often fail to adhere to the clearance received as follows:

- A pilot (driver) who is disoriented or who is preoccupied with checklist procedures (or ground duties) may taxi (drive) across an active runway after being cleared to hold short of the runway.
- Pilots also sometimes take off thinking they have been cleared when no such clearance has been issued. (Drivers may move a vehicle thinking they have been cleared when no such clearance has been issued). This is often the result of behaving according to habits that manifest themselves during periods of complacency or high workload which can result in the pilot's (driver's) actually forgetting to request a takeoff (or vehicle movement) clearance.

3. Inadequate scanning. Pilots have a similar problem. In many cases, better scanning and vigilance by the pilot (driver) might prevent a runway incursion. However, because of the factors noted above, pilot (driver) scanning is less than adequate. Lack of effective scanning and inadequate attention to airport signs, markings and lights, coupled with insufficient awareness of surface and landing traffic, is regarded as a principle pilot-related (driver-related) causal factor of runway incursions.

At some airports without a dedicated road system or with a complex runway/taxiway configuration, vehicles operated by the airlines and fixed-base operators are authorized to operate on the taxiways and to cross the runways. A lack of familiarity with the airfield environment sometimes results in inadequate or faulty position awareness on the part of these operators. Inadequate knowledge of radio communication procedures is another causal factor for vehicle operators in this category.

Vehicles authorized to be on the airfield but not on the movement area are normally authorized by airport management to operate on the ramp areas or on dedicated vehicle roadways in support of operations. These might include tugs, catering trucks, fuel trucks or other airline and fixed-base operator vehicles.

These vehicles are not required to communicate with the

tower when they operate in their assigned areas and, in most cases, are not equipped with radios having this capability. They become involved in runway incursions when they are operated outside their assigned areas and an incursion usually results from unfamiliarity with the airfield environment or airport operations, failure to understand the limits of authorized operations, or occasionally, forgetfulness. The principal causal factor for vehicle operators in this class is inadequate or faulty position awareness.

As the category implies, vehicles not authorized to be on the airfield simply do not belong on the airfield. Although some of these incidents have involved a deliberate attempt to enter the airfield, the majority represent an inadvertent entry. Consequently, when these vehicles are involved in an incursion, the underlying cause is usually a breach of security or inadequate measures to deter inadvertent entries.

Because causal factors can be related to the interaction between controllers, pilots and ground vehicle operators, it is important to understand the principal controller-related runway incursion causal factors and how they may contribute to the overall runway incursion problem as follows:

1. Erroneous scanning or failure to scan the runway or approach path (local controller and ground controller) which occurs for such reasons as inattention, distraction or boredom.

2. Forgetfulness (also common to pilots and drivers) about the traffic situation. Typical examples include the local controller authorizing the ground controller to cross the runway with two aircraft, then forgetting about the second aircraft; authorizing an aircraft into position and hold on the runway for an intersection departure, then forgetting that aircraft and clearing another for takeoff from the departure end of the runway; and granting a landing clearance on a closed runway.

3. Lack of or inadequate coordination between the local controller and ground controller on runway crossings.

4. Errors in sending or receiving clearances and instructions such as controller misidentification of an aircraft or failure to detect a missing or erroneous pilot acknowledgment.

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In 1987, an FAA Air Traffic Service review selected incidents from 1986 of surface-related operations errors (i.e., runway incursions attributable to air traffic control) and concluded that the principal factors contributing to these incidents were: defective scanning techniques, memory deficiencies, lack of adherence to procedures (primarily with respect to runway crossing situations) and inadequate active supervision in the tower cab.

The message that ground vehicle operators should receive from reading these air traffic controller causal factors is that forgetfulness, inadequate scanning, lack of coordination, misjudgment of traffic separation and errors in sending or receiving clearances can and do impact on runway incursions caused by vehicle operators. If there is doubt in the vehicle operator's mind about the safe operation of the vehicle, precautionary steps should be taken.

The FAA study outlines ongoing and planned activities as it pertains to airport operations as follows:

**Under the Associate Administrator for Air Traffic (AAT):**

There is an ongoing project to require ground vehicles operating on the runway for purposes other than crossing to communicate on the appropriate local control frequency. A notice of proposed rule making (NPRM) will request frequency management changes but coordination between the Federal Communications Commission and the airport operators has to be accomplished before this can be implemented. This will address the ground vehicle operator failure to understand clearances and instructions.

AAT has recently initiated activities that will lead to the procurement of a system known as the Airport Movement Area Safety System (AMASS). This system will be capable of automatically generating runway incursion warnings and alerts to tower controllers. It will use sensor reports from the airport surface detection equipment (ASDE)-3 system and software logic to determine, during all weather conditions, when a runway incursion incident is expected to occur or has occurred.

Evaluation of the New York Port Authority installation of airport stop bars at John F. Kennedy International Airport. The system was activated for testing in January 1989. The FAA Technical Center has been assigned overall FAA project management responsibility. The principal AAT concern is the workload

level and related operational procedures in this system. This is a joint effort of ATT, the Office of Airport Safety and Standards and the Office of Flight Standards. The project will address controller/pilot/vehicle operator forgetfulness, inadequate coordination, failure to understand clearances, ground vehicle operator inadequate scanning and faulty position awareness.

AAT is supporting an effort in which industry and government groups are examining improvements in standards for airport markings and signs. (See the following section on the Office of Airport Safety and Standards).

**Under the Office of Airport Safety and Standards (AAS):**

The development of a driver training manual for personnel who operate vehicles on the airport surface regarding the rules and procedures that apply in movement areas was to be completed and distributed in mid-1989. It has not been distributed.

Although FAA Advisory Circular 150/5340-18 established the standards for airport signs and markings for those airports which have them, it was not until January 1988, that FAR Part 139 was revised to require that all FAR Part 139 airports have signs and markings. A major activity is now underway by an FAA/industry working group to

revise and expand those standards.

Once agreement has been reached on revised standards for signs and markings, a videotape will be developed to train pilots and airport personnel on the meaning of the various types and configurations.

Hold-short markings lights for intersecting runways have been tested and will be installed at Boston's Logan International Airport for an in-service evaluation that will last about a year.

AAS states that airport operators are responsible for ensuring that ground vehicle operators — both employees and tenants — receive adequate training in the procedures that must be followed according to FAR Part 139. AAS recommends improved training aids and other education tools be developed to assist airport operators in achieving regulatory requirements. One possibility for doing so is to emphasize this requirement in the airport certification annual in-

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spection, as part of the review of the certification manual and the inspection visit to the airport.

AAS recommends a joint effort to develop a booklet containing examples of available posters addressing ground vehicle-related runway incursions for use as training aids.

The FAA Technical Center near Atlantic City, N.J., has previously tested wigwag lights — flashing yellow lights on both sides of a hold line — a concept similar to what is used in Europe. There is currently no U.S. activity in this area and AAS is recommending that a determination be made as to which airports could benefit from these lights. The Office of Flight Standards recommends installing wigwag lights in a simulator for operational evaluation by pilots.

All of the above activities will address ground vehicle operator-related causal factors.

#### **Under the Office of Flight Standards (AFS):**

AFS supports the John F. Kennedy International Airport (Jamaica, N.Y.) stop bar test, the revision of standards for airport signs and markings, and the evaluation of hold-short marking lights for intersecting runways. AFS recommends initiation of an activity to identify and evaluate techniques for shortening and simplifying taxi clearances. Techniques investigated should include the possible use of electronic guidance devices, special taxiway markings and standard taxi routes.

AFS recommends consideration be given to providing airport layout charts in the approach plates for all airports, not just the major facilities. This would improve pilots' ability to orient themselves on the airport surface in all weather conditions and would also improve coordination between pilots and tower controllers for taxi clearances.

#### **Under Advanced System Design Service (ADS):**

ADS will award a contract for the development and operational evaluation of the AMASS system.

ADS is sponsoring activities related to controlling

wildlife in the vicinity of airports since the presence of wildlife on a runway could pose a safety hazard to aircraft landing or taking off. These activities fall into the areas of evaluation of wildlife and habitat control techniques; evaluation of bird reaction to approaching aircraft; and investigation of real-time techniques for warning of wildlife activity.

### **General Recommendations of the Study**

1. A steering committee be established and chaired by the Office of Safety Oversight and with representatives from AAT, AAS, AFS, ADS and ASF, to address the runway incursion problem on a ongoing basis.
2. Accelerate development and field deployment of AMASS. Acceleration of the AMASS schedule is the single most important step the FAA could take to achieve a reduction in runway incursions and their associated collision risk.
3. Emphasize the analysis of pilot-related causal factors since most runway incursions are due to pilot errors/deviations and, yet, are not well understood. This analysis would serve as the basis for identifying procedural or technological solutions that can be implemented in the air traffic control system and the analysis would support a more focused and strengthened program of pilot and air-line awareness of the causes of runway incursions. ♦

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### ***About the Author***

*John A. Pope established John A. Pope & Associates, an aviation consulting firm located in Arlington, Va., U.S., after retiring in 1984 as vice president of the U.S. National Business Aircraft Association. He specializes in developing comprehensive operation manuals for corporate flight departments.*

*Pope, former Washington editor for “Aviation International News,” is a frequent contributor to Flight Safety Foundation’s publications.*

*He served as a command pilot in the U.S. Air Force and the Air National Guard. He retired as a colonel from the U.S. Air Force Reserve after 33 years of service.*

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