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Runway Incursions and Incidents Remain Safety Issues

Several factors contribute to runway incursions and incidents, including pilot workload and a busy air traffic control environment. A recent study examined these factors and made safety recommendations to pilots and controllers.

Editorial Staff Report

Improvements in airport surface markings, lighting and signage coupled with new procedures to enhance cockpit vigilance could substantially reduce the number of runway incursions and incidents, a recent study said.

The report, *Pilot Surface Incident Safety Study*, was prepared by the MITRE Corp. under contract to the U.S. Federal Aviation Administration (FAA).

"Despite ... efforts by the FAA and the aviation community, runway incidents, incursions, and accidents continue to persist," the study said. "[The] record underscores the importance of emphasizing and accelerating efforts to determine and better understand the causes and underlying human factors that contribute to runway incidents, and to identify effective solutions for preventing future incidents, incursions, and accidents."

The total number of runway incursions reported by the FAA increased each year from 1988 to 1990 and then decreased during 1991 and 1992, the report said. The number of incursions for the years 1988-1992 is shown in Figure 1.

The report said runway incident causal factors for pilots are "difficult, if not impossible to determine from most available safety data bases because the information [they contain] is limited, and inadequate to explain what caused the human to deviate or err."

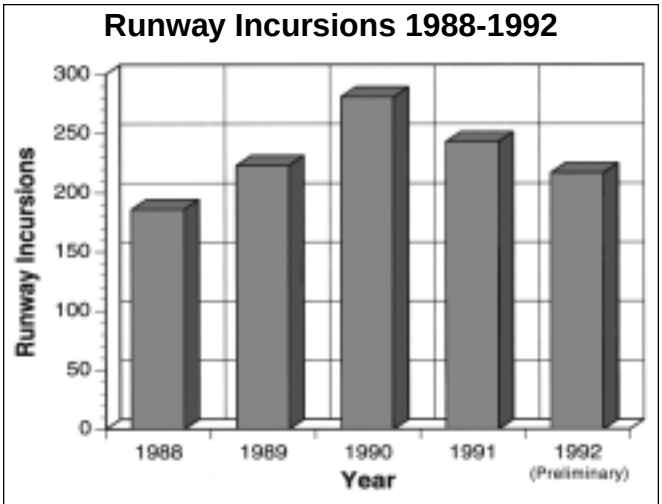

Figure 1

Because of these limitations, the "structured call back" feature of the U.S. National Aeronautics and Space Administration's (NASA) Aviation Safety Reporting System (ASRS) was used to obtain causal data from pilots involved

in runway incidents. NASA analysts, using a questionnaire developed by MITRE, interviewed pilots who had filed a report with the ASRS about their involvement in such incidents, which yielded more detailed information about the incidents.

"A total of 75 interviews were conducted," the report said. "Of the 75 total incidents, 49 occurred during taxiing, eight during takeoff and 18 during landing."

The report added: "The taxiing incidents involved 25 runway crossing and 24 runway entry events; the takeoff incidents involved seven unauthorized and one wrong runway events; and the landing incidents involved 14 unauthorized runway, two wrong runway and two failure to hold short events."

Based on the interview data, the report classified the incident causes into five categories: personnel, communication, memory, operations and orientation. Multiple causal categories and factors were assigned to each incident where appropriate. Each causal category was divided into groups of causal factors.

The personnel category, for example, included distractions, duty time, experience, performance, physical state and workload.

Communication factors included content, delivery, listening, mode and procedures. Orientation factors included airport layout, charts, familiarity, procedures, surface navigational aids and visibility. Operations factors were aircraft positioning, airline procedures, airport procedures, air traffic control (ATC) procedures and runway configuration. Memory factors included expectation, follow-through, information and procedures.

In the personnel category, the study concluded that "pilot performance was the predominant cause of the incidents analyzed [69 of 75J." A total of 161 causal factors in this category was assigned to the 69 incidents, according to the study.

"Poor cockpit management, complacency and lapses in judgment contributed to pilot performance deficiencies in the incidents studies," the report said. "Cockpit procedures and checklists for consistent surface operations were limited. Training in surface operations and in runway incursion prevention was lacking."

The report concluded that "there is a need for pilot performance standards in surface operations, including standardized briefings, procedures, checklists and callouts. Specific pilot roles, responsibilities and coordination must be clearly defined."

Cockpit workload and distractions were significant factors in the personnel category.

"Pilots were busy with communications, checklists, late engine starts, changed ATC instructions, maneuvering the airplane, monitoring inexperienced crew members ... [pilots] were rushed to complete tasks and pressured to meet flight schedules and ATC flow control times," the report said, and also noted the high workload of busy controllers.

The report concluded that "there is a need for pilot performance standards in surface operations, including standardized briefings, procedures, checklists and callouts."

The report added that pilots often did not cat properly or get adequate rest; were fatigued, had extended duty days, flew multiple flight segments and worked multiple consecutive-day schedules; were distracted by unusual and nonstandard conditions; or were new and inexperienced in their airplanes, in their cockpit positions or in their companies.

According to the report, the communication category was involved in the second largest number of incidents (55 of 75). A total of 131 causal factors in this category was assigned to these 55 incidents. The findings in this category indicated that:

- Pilots did not verbally coordinate ATC instructions with each other;
- Controllers did not issue pertinent traffic advisories or did not provide complete ATC instructions;
- Pilots heard ATC instructions but interpreted them incorrectly, did not request clarification about uncertain ATC instructions, or were listening on the wrong radio frequency;
- Controllers heard pilot readbacks, but interpreted them incorrectly;
- Radio frequencies were congested, transmissions were blocked and time to read back ATC instructions or to ask for clarifications was limited;
- Pilots used cockpit speakers instead of headsets; and,
- Controllers used confusing phraseology; gave incomplete or confusing instructions; gave complex instructions, including multiple items and numbers; or talked too rapidly.

The memory category was involved in the third largest number of incidents (43 of 75), according to the report. A total of 66 causal factors in this category was assigned to these 43 incidents. The findings in this category indicated that:

- Pilots lacked procedures to aid them in remembering ATC instructions and failed to write down surface-related ATC instructions;
- Controllers failed to emphasize unusual or nonstandard instructions, failed to make changes to previously issued instructions or failed to issue traffic advisories;
- Pilots expected to hear the normal, routine sequence of ATC instructions and often missed changes from expected instructions; and,
- Pilots acknowledged ATC instructions, but failed to comply with them.

Airlines were encouraged to provide training aids to help familiarize flight crews with airports and their distinctive surface operations.

The report said that the operations category was involved in the second lowest number of incidents (31 of 75). A total of 37 causal factors in this category was assigned to these 31 incidents. The findings in this category indicated that airlines lacked procedures requiring their flight crews to verbally coordinate ATC instructions and clearances with each other in the cockpit, and controllers routinely used runways as taxiways at some airports.

The orientation category was involved in the lowest number of incidents (22 of 75). A total of 58 causal factors for this category was assigned to these incidents. The findings in this category indicated that:

- Airports had signs that were too small, not lighted or missing; markings were confusing, faded, worn or missing; lighting was confusing or weak. Signs, markings and lighting were most often factors at night;
- Pilots were unfamiliar with or lacked recent experience at the incident airports;
- Airport layouts included wide pavement areas, complex intersections and dual-use taxiway/runways that often confused pilots; and,
- Restricted visibility and ambient light conditions confused pilots.

The study included extensive recommendations for each category examined. In the personnel category, the study urged development of "standard cockpit procedures for surface operations" and urged that a study be conducted to determine the impact of fatigue on flight crew performance.

Referring to the communication category, the study recommended that procedural requirements be established for flight crews to verbally communicate ATC instructions. It said that flight crews, when uncertain about instructions, should be encouraged to request clarifications from ATC.

"Proper radio discipline, phraseology, speech rate, enunciation and listening techniques should be emphasized," the study said.

The study said that pilot and controller organizations and airlines should be encouraged to distribute copies of *Call to Action: A Joint FAA/Industry Partnership to Improve Pilot/ Controller Communications* (1988) for use in training programs.

Recommendations for the memory category urged development of cockpit procedures or memory aids to reinforce short-term memory and to remind flight crews of pending instructions. ATC was encouraged to issue instructions when they are to be executed and to emphasize all infrequently used control instructions.

In the operations category, the study recommended establishing a company policy for flight crews to verbally coordinate ATC taxiing instructions and to verify them if there is disagreement, and to identify airports where runways are routinely used as taxiways and develop ways to limit or eliminate this practice.

Airport operators were encouraged to upgrade surface markings and lighting in recommendations based on the orientation category analysis. Airlines were encouraged to provide training aids to help familiarize flight crews with airports and their distinctive surface operations.

The study also contained statistical data that ranged from pilot experience and training to weather and lighting conditions associated with the runway incidents.

The study found that:

- Of the reporters, 72 percent (54) were captains whose experience ranged from 2,600 flight hours to 25,000 flight hours;
- Nearly three-fourths (55) of the reporters were from air carriers operating under U.S. Federal Aviation

Regulations (FAR) Part 121, and nearly one-fifth (14) were operating under Part 135;

- Almost all the pilots had some flight training and flight checks during the previous year, most involving recurrent training, and proficiency and line checks. "For two-thirds of the reporters (48), their training included no specific references to runway incursion prevention and awareness. For one-half of the reporters (38), there was no specific reference to pilot/controller communication awareness in their training";

- Of the total incidents (75), 85 percent (64) occurred during visual meteorological conditions;

- Of the total incidents, 60 percent (45) occurred during daylight, and one-third (25) occurred at night. Twenty of the night incidents occurred during taxiing, four during landing and one during takeoff;

- In nearly one-half of the incidents (35), there was no crew member, other than the captain, designated to monitor taxiing progression and route compliance. In nearly one-third of the incidents (22), there was no crew member, other than the captain, designated to provide external vigilance and scanning during taxiing operations;

- In nearly 70 percent of the incidents (52), there was no company procedure requiring verbal coordination of all ATC instructions between the pilot not flying and the pilot flying. In 20 percent of the incidents (15), either the captain or the first officer was using a cockpit speaker instead of a headset. In 40 percent of the incidents (30), the pilots stated that intracockpit communications were contributing factors to the incidents;

- In the 49 taxiing incidents, 46 pilots reported that they acknowledged their taxiing instructions with a complete or partial readback. Partial readbacks were caused by frequency congestion (6), cockpit workload (3) and failure to copy total instructions (3). None of the pilots was instructed by ATC not to read back;

- Of the eight takeoff incidents, seven involved unauthorized takeoffs;

- Of the 18 landing incidents, 14 involved an unauthorized landing. In all 14 incidents, pilots did not contact the towers in a timely manner and did not receive ATC clearances to land. Pilots suggested several factors contributed to the incidents, including "distraction in the cockpit," "not on frequency," "thought we had contacted tower" and "thought I had been cleared"; and,

- Of the 75 total incidents, 17 involved a conflict situation with another airplane - 14 during taxi, two during landing and one during takeoff.

Clearly, pilots and controllers have the most opportunity to prevent runway incursions and incidents.♦

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