FLIGHT SAFETY FOUNDATION

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# Gulfstream II Collides with Stalled, Unlighted Vehicle After Tower Controller's Clearance to Land

***The U.S. National Transportation Safety Board said that the flight crew received a clearance to land on the same runway where the tower controller previously had issued a clearance for electricians to repair the runway-centerline lights. Other factors were darkness, partial failure of the runway-centerline lights, the vehicle's loss of engine power, and a failure to have adequate emergency-backup lighting.***

*FSF Editorial Staff*

On March 25, 1997, a Grumman Gulfstream II, operated by PAB Aviation, collided with an unoccupied electrical-maintenance truck during landing rollout on Runway 31 at LaGuardia Airport, Flushing, New York, U.S. There were no injuries; two pilots and two crewmembers traveling as passengers were aboard the aircraft. The Gulfstream II was substantially damaged, and the truck was destroyed.

The U.S. National Transportation Safety Board (NTSB) said, in its factual-investigation report of the accident, that the probable cause of the accident was "the tower controller's inadequate service by clearing the airplane to land on the same runway where he had previously cleared a maintenance vehicle to perform maintenance to the runway-centerline lights."

The report said, "Factors related to the accident were: darkness, partial failure of the runway-centerline lights, the electric-maintenance vehicle's loss of engine power, and a failure to have adequate emergency-backup lighting."

The report cited the U.S. Federal Aviation Administration (FAA) *Air Traffic Control Handbook*, 7110.65J Section 3-1-5, "Vehicle-Equipment-Personnel on Runways," which said that air traffic controllers must "a. Ensure that the runway to be used is free of all known ground vehicles, equipment and personnel before a departing aircraft starts takeoff or a landing aircraft crosses the runway threshold."

LaGuardia Airport is owned and operated by the Port Authority of New York and New Jersey (PNY&NJ) and certificated under U.S. Federal Aviation Regulations (FARs) Part 139. The airport has two runways — Runway 4/22 and Runway 13/31 — each 7,000 feet [2,134 meters] long and 150 feet [46 meters] wide (the Runway 31 threshold is displaced 175 feet [53 meters]).

"Runway 31 is grooved asphalt, except for the last 900 feet [274 meters] which is constructed of grooved concrete on an elevated deck above the Rikers Channel," said the report.

"Runway 31 is configured for [a] localizer instrument approach and is equipped with high-intensity edge lights and centerline lights." Runway 31 has a [visual-approach slope indicator (VASI)] system, [runway-end-identifier lights (REIL)] and dual parallel taxiways the full length of the runway. Runway 4/22 crosses Runway 13/31 between 1,000 feet (305 meters) and 1,300 feet (396 meters) from the Runway 13 approach end.

The controller, 33, joined FAA in 1988, began work at LaGuardia Airport in 1992 and was certified at full-performance level at LaGuardia Tower in 1994. He was qualified to work as the controller-in-charge. The controller's proficiency training since 1992 included the following subjects: runway incursion, visually scanning the runway, surface-operations awareness, standard operating procedures (SOPs) for taxi into position and hold, and midnight runway-selection program. The report found no evidence of controller fatigue or health problems.

The report said, "[The controller] did not work any overtime in the last round of shifts prior to the accident. The day of the accident, his assigned shift was 2200-0700 [hours] local time … on the second day of a four-day work week. The previous shift was the same. … He is not on any medications. He described his general health as 'good.'"

The controller received a relief briefing for the local-control position and went on duty at 0011. On the day of the accident, all LaGuardia Airport controller positions were combined as one local-control position from 0011 until after the accident; that is, one controller was assigned to conduct operations using combined radio frequencies for ground control, local control and approach control.

The report said, "A review of the communication tapes and transcript for the LaGuardia [Tower] from 0425 to 0518 reveals that the same controller was working the local [-control] and ground-control positions.

"[Two] electricians stated that at 0410, while working on the lighting system on Runway 4/22, which was closed for contract maintenance work, they contacted the control tower on ground-control frequency to inform [the controller] that they were working on the closed runway ([Runway] 4/22)." Later, the electricians told the tower that they needed to work on the active runway.

About 0430, the electricians — operating a truck used for runway-light maintenance with radio call sign "vehicle 1277" — received clearance from the controller to operate the vehicle on Runway 13/31.

The report said, "At 0430:14, the operator of [the PNY&NJ airport electrical maintenance truck identified as vehicle 1277] made initial contact with the local controller on the ground-control frequency. Six seconds later, the vehicle operator said, 'Like to get on runway thirteen for some lighting maintenance.' The tower controller replied, 'Twelve seven seven, proceed on runway one three three one.'

"At 0430:26, [an electrician in] vehicle 1277 questioned 'Four is still closed, is that correct?' to which the controller responded, 'That's correct.' No further transmissions were made to vehicle 1277 from the controller."

The electricians repaired runway-edge lights beginning at the departure end of Runway 31. Work on the runway-edge lights ended about 0500, and the electricians began to repair inoperative centerline lights moving north.

"At about 0505, they began to repair a centerline fixture (located about 1,800 feet [549 meters] from the Runway 31 threshold)," said the report. "The electricians stated that the truck was parked facing north with headlights, tail-lights, a 300-watt halogen lamp, and the flashing roof beacons all [turned] on."

The Gulfstream II was on a positioning flight and departed about 0430 on an instrument flight rules flight plan from Lehigh Valley International Airport, Allentown, Pennsylvania, U.S., to LaGuardia Airport under FARs Part 91. The captain was the pilot flying, and the first officer was the pilot not flying.

The captain had an airline transport pilot certificate (ATP); type ratings for the Gulfstream II, Lockheed Jetstar and Learjet; and approximately 9,900 hours total flight time, including 3,860 flight hours in the Gulfstream II. The first officer had an ATP certificate; type ratings for the Gulfstream II, Gulfstream I, Douglas DC–3, IAI Westwind, Hawker 125, and Convair 240, –340 and –440; and approximately 21,000 hours total flight time, including 4,000 hours in the Gulfstream II.

At 0457, the flight crew of the Gulfstream II told New York Terminal Radar Approach Control that the automatic terminal information service (ATIS) "information foxtrot" had been received. Regarding runway status, this ATIS recording said, "Notam [notice to airmen] runway four two two closed." The alphabetical designator "information golf" was not used, and the controller did not verify that the Gulfstream II crew had received subsequent ATIS "information hotel" that contained the same statement about runway status, said the report.

"At 0507, the first officer made the initial radio call to LaGuardia Tower, local controller, to request clearance to land," said the report.

Night visual meteorological conditions were reported when the aircraft arrived. NTSB said that the reported weather at the time of the accident was: wind from 060 degrees at six knots; visibility 10 statute miles (16 kilometers); ceiling 25,000 feet overcast; temperature 37 degrees Fahrenheit (F; 3 degrees Celsius [C]); dewpoint 27 degrees Fahrenheit (minus 3 degrees C); barometric pressure 30.51 inches of mercury (1033 hectopascals). The electricians continued to work on the active runway while the Gulfstream II crew conducted a visual approach.

"When the lead electrician began to remove the bolts from the centerline light fixture with the impact wrench [powered by an inverter on the truck that changed 12-volt direct current to 115-volt alternating current], the truck engine stalled. The lead electrician immediately attempted to restart the truck, but was unable to [start the truck], so he shut off all the vehicle lights to reduce the electrical load, and again attempted to start the truck with the lights off."

"At [0506:35], a New York Terminal Radar Approach Control … controller advised the [LaGuardia Airport] tower controller that an aircraft was inbound. At [0506:57], the pilot of [the Gulfstream II] transmitted on the local control frequency and said, 'LaGuardia Tower, one one seven fox juliet is with you' [when the Gulfstream II was about 12 miles (19 kilometers) from the airport]."

At 0507:03, the controller responded to the Gulfstream II crew's call, scanned Runway 13/31, and, not seeing the stalled vehicle, issued a clearance to land on Runway 31.

"[The] tower controller transmitted on both local [-control frequency] and ground-control frequency and said, 'One seven fox juliet, LaGuardia runway three one cleared to land, winds reading zero seven zero at five,'" said the report. The Gulfstream II crew acknowledged this clearance.

"Neither electrician heard the tower grant landing clearance to [the Gulfstream II], although they could not explain why, since they were within six feet [1.8 meters] of the truck cab, with the radio(s) turned up [and] with the truck door open."

At 0509:50, an occupant of another maintenance vehicle — call sign "vehicle 51" — said in a radio transmission on ground-control frequency, "LaGuardia ground, vehicle five one to cross runway three one at the [Runway 4–22] intersection."

The controller said, "Five one hold short."

At 0510, an occupant of vehicle 51 said, "Five one holding."

At 0510, one of the electricians operating vehicle 1277 saw the landing lights of an airplane on approach to Runway 31.

"At that moment [an electrician operating vehicle 1277] … informed the lead electrician, who immediately radioed the tower that they were still on the runway," said the report.

"At 0510:27, [the lead electrician operating vehicle 1277 said on the ground control frequency], 'Uh, twelve seven seven, we're stuck on the runway, we're stuck on the runway.'"

Both electricians later told investigators that they believed the airplane was moving toward them at a high rate of speed.

"The lead electrician then turned on the headlights and ran from the truck behind the other electrician to escape the immediate life-threatening situation," said the report. "They estimated that the airplane struck the truck about two seconds after they ran from the truck."

The following excerpt from the cockpit voice recorder (CVR) transcript shows the timing of the accident sequence and related radio transmissions:

> "0510:30: Sound of thump similar to aircraft touching down on runway. (Heard over cockpit area microphone);
>
> "0510:31: Go around, aircraft on runway go around, aircraft on runway go around, seven fox juliet go around. (Identified as radio transmission from controller [on the ground-control frequency and the local-control frequency]);
>
> "0510:37: Fox juliet's on. (Identified as radio transmission from copilot); and,
>
> "0510:43: Sound of impact. (Heard over cockpit-area microphone)."

The report said that no transmissions from vehicle 1277 or vehicle 51 were recorded by the CVR.

"At 0510:56, the controller asked the [Gulfstream II] crew if everything was 'OK,'" said the report.

After the accident, the Gulfstream II crew told investigators that the controller's go-around directive was received while the PF was applying reverse thrust during the landing rollout.

The report said, "The [pilot-in-command (PIC)] and [second-in-command (SIC)] reported that the visual approach and landing touchdown were uneventful. During the landing roll, while the PIC was applying reverse thrust, the controller instructed the flight to go around. The SIC then advised the controller that the airplane was on the runway. Shortly thereafter, the PIC observed a vehicle on the centerline of the runway.

"The PIC's attempts to avoid the vehicle were unsuccessful, and the airplane's right wing and right main landing gear struck the vehicle. When the airplane came to rest, the PIC shut the engines down, and the passengers and crewmembers evacuated. The crew stated that the runway lights were on during the approach and landing, and that they did not observe any lights on the vehicle located on the runway centerline.

"Examination of the wreckage revealed that the maintenance vehicle came to rest approximately 2,800 feet [853 meters] beyond the approach end of the runway. The [airplane's] right main landing gear had separated and came to rest about 2,950 feet [899 meters] beyond the approach end of the runway. The airplane came to rest off the right side of Runway 31, about 4,050 feet [1,234 meters] beyond the approach end of the runway."

The controller then followed airport-emergency SOPs, using the emergency-conference telephone line to request an immediate aircraft rescue and firefighting (ARFF) response. PNY&NJ police dispatched seven ARFF trucks and applied aqueous film-forming foam and water around the Gulfstream II, which was leaking fuel. There was no fire. The crewmembers and passengers had evacuated when the ARFF equipment reached the aircraft.

A second controller, who was in LaGuardia Tower but not signed on to any position, relieved the controller on duty shortly after the accident.

The report said, "[The second controller] said that it took a second for her to absorb what happened, but it was obvious when the airplane was off to the side. She called [New York Terminal Radar Approach Control] from the cab coordinator position to advise that the airport was closed due to an accident. She then went to the desk to call her supervisor … [and air traffic manager] to advise [them] of the accident. She then called the command center and told them about the accident and asked them to disseminate the information. She relieved [the controller on duty] from the control position and [the supervisor] arrived shortly thereafter. She called the National Weather Service and then the airlines started calling, asking about the status of the airport. She prepared a new ATIS to advise that the airport was closed."

## Controller Said Vehicle Unseen Before Gulfstream II Landed

NTSB's report said that the controller who was on duty at the time of the accident did not remember seeing vehicle 1277 prior to issuing the landing clearance to the Gulfstream II crew.

"He first visually saw the airplane when the aircraft was on two-mile [3.2-kilometer] final [approach] and … he did not know if the landing gear was down, but saw the landing light. He scanned Runway 13/31 and saw vehicles on Runway 4/22. He saw one vehicle on the north side of Runway 4/22 holding short of Runway 13/31. He stated that there may have been more vehicle activity on Runway 4/22, but not near Runway 13/31. The vehicle he saw was lit, but he could not recall how. When he scanned Runway 13/31, the runway was clear. He stated that at the time of the accident … there was no sun, and could not recall if there was a moon or moonlight.

"He again saw the aircraft at a 1.5-mile [2.4-kilometer] mile final [approach] when a vehicle operator called to cross Runway 31. He instructed the vehicle to hold short of runway 31 and visually located the vehicle. He looked back at the airplane, then heard someone say they were stuck on the runway. He issued go-around instructions and looked to find the vehicle, but he could not see anything. Although the vehicle operator did not say what runway he was on, [the controller] was only concerned with one runway. He recalled that he saw one vehicle holding short of Runway 31 when the airplane was over the over-run area not touching the ground. He followed the airplane down the runway and everything looked normal. He asked the flight crew if everything was OK. After the flight crew said 'something,' he saw the airplane swerve to the right (north), and he reached for the emergency conference line. … He stated that the emergency vehicles responded quickly. He never saw [vehicle 1277] until it was daylight."

The report said that the second controller in the tower "did not 'consciously' look for any vehicles or the lights on the vehicles; however, she said that 'all vehicles who operate on the runway have lights on all of the time.'"

## Report Summarizes Other Safety Issues

The report said that the following safety issues also were considered during NTSB's investigation:

- "[The controller] did not experience any radio or radar problems the night of the accident, and stated that the accident airplane was the first arrival since about 0145";

- "The facility is not equipped with [airport-surface-detection equipment (ASDE-3)]";

- "[An FAA full-facility evaluation of LaGuardia Tower conducted in October 1995 resulted in the following finding in November 1995.] 'Traffic was not issued to aircraft when personnel and equipment were operating on or near the movement area.' The facility manager responded [in part] 'All personnel were briefed on the requirement to issue traffic when personnel and equipment are operating on or near the movement area. … Supervisors continue to pay special attention to this item during daily operations, especially during winter snow-removal operations. We have monitored specialists for more than 90 days and have not observed any additional errors, and are certain of continued compliance. … We consider this item closed'";

- A follow-up evaluation in January 1997 said in part, "All operations personnel were briefed on the requirement to issue traffic advisories to pilots when personnel and equipment were operating on or near the movement area. … Internal assessments over a three-month period revealed no discrepancies. … During position monitoring, evaluators did not observe any instances when specialists were required to issue traffic advisories to pilots regarding personnel and equipment operating on or near the movement area. Evaluators concurred that the actions taken by the [LaGuardia Tower air traffic manager] were sufficient to preclude problem recurrence";

- The controller said that binoculars were not used to visually scan Runway 31 before he issued a landing clearance to the Gulfstream II crew, and that binoculars were not required;

- "While [the controller] was on the local-control position, he saw vehicles on Runway 4/22. He could not recall if the yellow lights were lit on the vehicles because 'through the course of the night I worked a lot of vehicles'";

- "The LaGuardia Tower [ground-control position binders] and [local-control] position binders [required by FAA Order 7210.3 dated June 20, 1996] contain no information regarding the use of memory aids to remind controllers when a vehicle is occupying an active runway";

- A second controller who was present in LaGuardia Tower during the accident was asked about techniques to remind controllers that vehicles are operating on an active runway. The second controller said that vehicle strips have been prepared for standard vehicles that are operated on runways;

- "The [second controller said that she] moves the strip to either the departure bay (departure runway) or the arrival bay (arrival runway), depending on which runway the vehicle enters. If another vehicle, other than a standard vehicle, calls to enter a runway, [the second controller] writes the information on a piece of paper. [The second controller said that she] would write the vehicle call sign or 'subject.' If [the vehicle] is a 'tow job,' the controller writes the gate [number]. … She stated that she normally uses this technique during the midnight shift";

- "[The controller used] memory joggers [— described as a 'vehicle strip' by the LaGuardia Airport air traffic manager —] to remind him that a vehicle is on an active runway during peak hours, busy periods and daytime. He would use [memory joggers] during a midnight shift [if] 'it's a factor,' which would be aircraft or heavy aircraft activity. It is possible he would not use it during light traffic. [According to the controller], there [were] no facility orders, [SOPs] or teaching regarding the use of memory joggers; it is a technique. He could not recall if he used any memory jogger [when] vehicle 1277 requested to enter Runway 31 the morning of the accident, nor could he recall if he saw lights on the … vehicle";

- "The … air traffic manager said, 'The use of a vehicle strip has always been part of the training process which is taught and utilized by all controllers at LaGuardia Tower. Although there is no requirement for written direction, LaGuardia Tower established a written directive detailing the use of the memory jogger. The directive will be incorporated in the revised [SOPs]'";

- "A review of the recorded [air traffic control] voice communications [indicates] that the local controller did not confirm that the pilot had the current ATIS";

- "[After the accident,] the [PNY&NJ] police had [PNY&NJ] maintenance personnel examine [the accident vehicle] and found that the vehicle battery was charged, and eight gallons [30 liters] of gasoline remained in the fuel tank";

- "Both electricians stated that performing routine electrical maintenance on open runways was a common practice, but they questioned the wisdom of continuing that practice";

- "[The electricians] stated [to investigators] that they [left their vehicle door open and the radio volume at a high setting] because they 'didn't trust the tower.' When asked to further clarify that statement, they explained that no criticism of the tower [personnel] was intended, they just didn't want to 'assume anything.' … [The electricians] believed that the runway lights were set at about step 3 [medium intensity] at the time of the accident. The electricians recalled at least one previous occasion when an aircraft was cleared to land, while they were still working on the runway, but they did not recall the exact date. (A review of PNY&NJ operations logs revealed no reports of such an occurrence.)";

- One of the electricians told investigators, "The [vehicle] lights got dim, and the truck stalled out during the process of removing the fixture. … My partner said [that] there is an aircraft landing, and I knew the truck wouldn't start. … I just could not believe this aircraft was coming in. At that point, the aircraft was crossing the threshold. I could not believe the aircraft was there because I knew that I had clearance to be out there";

- One electrician told investigators that he had seen an airport maintenance truck's engine stall previously while an inverter was in use;

- "Vehicle 1277 was not listed [in airport SOPs among vehicles authorized to operate on the airport movement area]"; and,

- "The PNY&NY airport operations construction agent who was overseeing the contract work being done on the closed Runway 4/22 said that 'prior to the accident, he had observed the [vehicle 1277] electricians' truck with all its lights on, including its overhead beacon. … He also stated that performing electrical repairs on a runway while it was still open was normal procedure.'"

## FAA Changes Procedures, Recommends Improvements

NTSB's factual report contained the following excerpt from an FAA written directive dated April 16, 1997: "In light of recent events, the following procedures will [be] in effect immediately and will be incorporated in the LaGuardia Tower [SOPs] order.

- "The local[-control] and ground-control positions shall not be combined prior to 0000;
- "All vehicles on active runways will be on the local-control frequency;
- "Whenever a vehicle is cleared onto an active runway, the 'vehicle' strip shall be placed in the local-control flight strip bay for the affected runway; [and,]
- "During night operations, when [PNY&NJ staff] is working on the active runway(s), [the staff] will request that the runway-edge light be turned off."

FAA's Airports Division, Safety and Standards Branch, also recommended the following safety improvements to PNY&NJ:

- "Vehicles operating on the [airport operations area (AOA)] should carry flares for emergency use;
- "Require a hand-held radio in addition to the vehicle radio;
- "Require self-contained battery-powered strobe lights on all vehicles for use during low-visibility [conditions] and night-time conditions. This is in addition to the normally operated rotating beacon required on all vehicles;
- "During daylight operation, all vehicles operating on the AOA must have the driving/headlights operating on high beam;
- "[Recommended] SOP — If ATC loses radio contact with vehicles on the runway, [ATC] should raise and lower runway/taxiway [lights], centerline [lights], touchdown[-zone] lights, VASI and REILs from step 1 [low intensity] through step 5 [high intensity] several times to draw attention;
- "All vehicle operators must be familiar with ATC light-gun signals;
- "Require a daily inspection of vehicles to ensure that all lights and signals are operational and that the [fuel levels] and engine-fluid levels are [filled to the proper level];
- "All power tools that draw high current/amperage must be operated by an independent generator, and not [by] the vehicle [engine's electrical] system;
- "When radio contact with ATC is not maintained for a period of more than 15 [minutes to] 20 minutes, a radio check [of continued communication capability] must be completed;
- "Whenever maintenance work is performed, a [notice to airmen (Notam)] must be issued for … '[personnel] and equipment on or in the vicinity of the runway.' If possible, work should be scheduled when there is the least impact to air traffic and air carrier operations so that the runway may be closed;
- "In addition to issuing a Notam, the [ATIS] broadcast should state the conditions and location where construction or maintenance work is in progress; [and,]
- "The *Port Authority Airport Rules and Regulations* were last revised on Sept. 1, 1991. These should be reviewed and amended as appropriate."

NTSB asked LaGuardia Airport Tower management about the status of deploying airport surface detection equipment (ASDE-3) and the airport-movement-area safety system (AMASS). (See "Runway Safety Program Evolves to Counteract Persistent Incursion Rate" on page 7 for descriptions of these technologies.)

LaGuardia Airport Tower management said: "[LaGuardia Airport] is [scheduled] for an ASDE-3 installation/commission no later than August 1998. Originally, this project was to be included with the new tower project. But due to safety concerns, we were able to push it ahead as a stand-alone [project]."♦

[Editorial note: This article, except where specifically noted, is based entirely on U.S. National Transportation Safety Board (NTSB) Factual Report NYC97FA062 and Brief of Accident NYC97FA062. The nine-page report and two-page brief include a 140-page supporting documentation file containing diagrams, photographs and appendixes.]

## Additional Reading from FSF Publications

Rosenberg, Barry. "Radar Technology, Satellite Systems at Forefront of Global Effort to Reduce Runway Incursions." *Airport Operations* Volume 22 (March–April 1998).

Adam, Glennis L.; Kelley, David R. "Reports by Airline Pilots on Airport Surface Operations: Part 2. Identified Problems and Proposed Solutions for Surface Operational Procedures and Factors Affecting Pilot Performance." *Flight Safety Digest* Volume 16 (March–April 1997).

Pope, John A. "The Airport Side of Runway Incursions." *Airport Operations* Volume 16 (September–October 1990).

## Runway Safety Program Evolves to Counteract Persistent Incursion Rate

In this decade, U.S. efforts to prevent runway incursions have stressed human factors through education while developing technologies that provide safety redundancy — especially surface radar to depict activities that might be obscured or invisible to air traffic controllers, and to predict collisions during ground operations so that controllers are alerted in time to take corrective action.

The U.S. Federal Aviation Administration (FAA) defines a runway incursion as "any 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." This definition only applies to airports that have operating air traffic control towers.

U.S. Federal Aviation Regulations (FARs) Part 139.329, "Ground Vehicles," said in part, "Each certificate holder shall … (c) When an air traffic control tower is in operation, ensure that each ground vehicle operating on the movement area is controlled by one of the following: (1) two-way radio communications between each vehicle and the tower; (2) an escort vehicle with two-way radio communications with the tower to accompany any vehicle without a radio, or; (3) measures acceptable to the Administrator for controlling vehicles, such as signs, signals or guards, when it is not operationally practical to have two-way radio communications with the vehicle or an escort vehicle. … (e) Ensure that each employee, tenant or contractor who operates a ground vehicle on any portion of the airport that has access to the movement area is familiar with the airport's procedures for the operation of ground vehicles and the consequences of noncompliance." Part 139 defines the "movement area" as "the runways, taxiways and other areas of an airport which are used for taxiing or hover taxiing, air taxiing, takeoff and landing of aircraft, exclusive of loading ramps and aircraft parking areas."

U.S. studies published in the early 1990s showed that runway incursions primarily are caused by one or more of the following: improper clearances, incomplete communications, poor ground navigation and lack of situational awareness.[1] Prevention of runway incursions requires vigilance from everyone involved in conducting surface operations.

"Most reported incursions have occurred in good visibility conditions," said a 1991 report.[2] "Air traffic controllers currently rely on visual and memory processes to control and maintain safety of surface movements. … The task results in high controller workload and dependence on short-term memory skills. There are no safety backups to monitor for human error like those that exist in en route [facilities] and terminal facilities using automated traffic alerts. … The reaction time for a tower controller to detect and resolve conflict is substantially shorter than that required in other air traffic control facilities. … There is a need for an automatic surveillance system that provides a clear and reliable position and positive identification of surface traffic within the area of responsibility of the tower controllers, instead of relying solely on controller situational awareness."

FAA counts operational errors by air traffic controllers monthly and compares the total number of operational errors to the total number of facility activities. FAA defines surface operational errors as "occurrences attributable to the air traffic control system that [result] in less than applicable separation [minimums] between two or more aircraft, or between an aircraft and terrain or obstacles and obstructions."

In FAA's *Aviation System Indicators: 1998 Annual Report,*[3] 898 operational errors occurred in calendar year 1998 during 160,570,789 facility activities, producing a rate of 0.56 operational errors per 100,000 facility activities. From 1992 through 1998, the annual operator error rate varied from 0.51 to 0.56. The data do not distinguish operational errors involving commercial aircraft from those involving general aviation aircraft.

In July 1999, the U.S. Department of Transportation (DOT) — which oversees FAA — conducted an audit of FAA's implementation of the 1998 Airport Surface Operations Safety Action Plan.[4] The report included the following findings regarding FAA's efforts to reduce runway incursions:

- "[The DOT Inspector General] reported [in February 1998 that] runway incursions had increased 54 percent during 1993 through 1996, and that FAA's Runway Incursion Program (now called the Runway Safety Program) needed to be strengthened. We found that the 1995 Runway Incursion Action Plan, designed to coordinate systemwide runway-incursion prevention initiatives, was not working as intended;

- "Runway incursions can have serious consequences. Eleven runway accidents dating back to 1972 have claimed a total of 719 lives and destroyed 20 aircraft. Since 1990, four major runway accidents have claimed 45 lives. Reducing runway incursions has been on the [U.S.] National Transportation Safety Board annual 'Most Wanted' list of transportation-safety improvements since the inception of the list in 1990;

- "The upward trend in runway incursions continued with 325 incursions in 1998, an 11 percent increase, primarily attributed to increases in pilot deviations." [The total included 51 incursions attributed to vehicle/pedestrian deviations, 183 incursions attributed to pilot deviations and 91 incursions attributed to operational errors. Vehicle/pedestrian deviations involve vehicles, nonpilot-operated aircraft or pedestrians on runways or taxiways without authorization from a controller. Pilot deviations are errors that violate FARs.];

- "Runway incursions continue to be a serious problem in 1999. FAA's data show that runway incursions from January [1999] through June 1999 remain at a high level. There were 149 incursions during the first six months of 1999 as compared to 150 incursions during the first six months of 1998;

- "In our opinion, FAA's progress in reducing runway incursions has been too slow. Stronger oversight is needed to ensure follow-through on planned initiatives to reduce runway incursions, including projects to reduce pilot deviations. Without immediate progress in implementing its plan, it is unlikely that FAA will achieve its goal of reducing runway incursions by 15 percent by the year 2000 and mitigate the risk of a tragic runway accident. Further, FAA has not identified all actions and funding necessary to reduce runway incursions. Also, developmental and operational problems continue with [the airport-movement-area safety system (AMASS)], a major technology-based initiative to help air traffic controllers respond to human errors. AMASS will not meet its August 2000 deployment date for the last system because of unresolved human factors issues and [because] the revised delivery date has yet to be determined. … AMASS is a system that continually monitors airport surface traffic and automatically alerts air traffic controllers to potential conflicts. AMASS is currently installed and undergoing testing at Detroit [Michigan, U.S.], St. Louis [Missouri, U.S.] and Atlanta [Georgia, U.S.] airports; [and,]

- "FAA plans to install 40 AMASS [systems] at 34 airports nationwide. The contract was awarded in September 1990. In 1993, AMASS was estimated to cost US$59.8 million and be installed in 1996. … [Total funds obligated for AMASS, as of May 31, 1999, are $74.2 million, said the report.] Software problems have been the primary cause for cost increases and schedule delays. … Unresolved human factors issues are now causing additional delays. … For example, the AMASS alert message on the ASDE–3 display is not readable beyond 10 feet [three meters], which is a concern since controllers are often farther than 10 feet from the display during their normal operations. … In addition to developmental problems, AMASS is experiencing operational problems. For example, even when the 40 systems are deployed, FAA will initially limit AMASS capabilities to detecting conflicts that *occur on all active runways* [emphasis in original] for arrivals and departures. [FAA is limiting AMASS capabilities because of its longstanding concern that false alarms will diminish controllers' confidence in the system, said the report.] Controllers will not be alerted to potential conflicts that involve traffic on runways or taxiways that intersect the active runways. As AMASS is adapted to each site, additional areas of coverage may be added."

The DOT report said that FAA agreed with the six recommendations of DOT auditors and will increase direction from senior administrative levels; issue standard operating procedures for the Runway Safety Program; issue a revised vehicle/pedestrian form; complete funding strategies for future years; analyze plans for investment in future technologies; and prioritize human factors changes and other changes in the AMASS program.♦

— FSF Editorial Staff

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