The Increasing Risk of Runway Incursions - The Most Dangerous Part of Air Travel May Be the Time Spent on the Ground

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THE INCREASING RISK OF RUNWAY INCURSIONS—THE MOST DANGEROUS PART OF AIR TRAVEL MAY BE THE TIME SPENT ON THE GROUND

Kenneth M. Thomas*

“Taxiing on the airport surface is the most hazardous phase of flight.”

- Jane Garvey, Administrator of the Federal Aviation Administration, in her opening remarks at the Runway Safety National Summit, June 2000.¹

“When I board an aircraft, I believe that the greatest threat to my life is a collision on the runway.”

- Jim Burnett, Former Chairman, National Transportation Safety Board.²

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* B.S., Aerospace Engineering, Iowa State University, 1995; J.D., Southern Methodist University, Dedman School of Law, 2002. Before entering law school, the author worked in the civilian and military aerospace industries as a Systems Engineer, focusing on aircraft systems design and systems flight-testing. This article is dedicated to all those in the aviation community who strive to provide the safest possible air transportation system. A safe and strong aviation system is critical to the infrastructure of a great nation.


² NBC Nightly News (NBC television broadcast, Dec. 1, 2000).
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GLOSSARY OF ABBREVIATIONS

ADS-B Automatic Dependent Surveillance – Broadcast
ALPA Air Line Pilots Association
AMASS Airport Movement Area Safety System
AOPA Aircraft Owners and Pilots Association
ASDE (-3, -X) Airport Surface Detection Equipment
ASRS Aviation Safety Reporting System
ATC Air Traffic Control (including ground control)
ATP Airline Transport Pilot
CFR Code of Federal Regulations (for Aeronautics and Space)
DOT Department of Transportation
DOT/IG Inspector General of the Department of Transportation
FAA Federal Aviation Administration
FAR Federal Aviation Regulations
I. INTRODUCTION

It is a common axiom that the drive to the airport is more dangerous than the flight to the destination. If the current trend in airport ground safety continues, the trip between the gate and the runway may become the most dangerous portion of air travel.

The world’s worst civilian aviation accident occurred on March 27, 1977, when two commercially operated Boeing 747s collided, killing 583 of the 613 people onboard both aircraft. With the increasingly crowded skies over most parts of the world, this type of accident was seemingly inevitable. However, this accident did not occur in the skies. The accident occurred on a fog-covered runway on Tenerife in the Canary Islands. As a KLM Royal Dutch Airlines 747 began its takeoff roll, another 747 operated by Pan Am was taxiing down the same runway in the opposite direction. When the KLM crew saw the other aircraft, they attempted an early take-off, but the two jumbo-jets collided and burst into flames. All 235 people aboard the KLM jet were killed. The Pan Am jet was cut in half, killing 348 people.

In aviation parlance, this type of accident is known as a “runway incursion.” In the aftermath of the Tenerife accident, the aviation industry and aviation agencies around the world promised to reduce the potential for runway incursions. But, in the twenty-five years since the Tenerife disaster, runway incursions in the United States have been occurring at an increasing rate.
The goal of this article is to discuss the historical background of the runway incursion problem in the United States and to assess the response by the Federal Aviation Administration (FAA) and other aviation authorities in an effort to continue to ensure that aviation remains the safest form of travel.

Part II provides a background study of the runway incursion problem, including the statistical rise in runway incursions. Part III discusses the current state of technological development of systems designed to aid pilots and air traffic controllers in preventing runway incursions. Part IV discusses potential methods for reducing the occurrence of human error leading to runway incursions. Part V discusses the initiatives started by the FAA in the last decade to reduce the runway incursion problem. Part VI discusses the current direction of the FAA in its effort to reduce runway incursions. Finally, Part VII concludes with a critique of the FAA’s actions aimed at reducing runway incursions.

II. A BASIC STUDY OF RUNWAY INCURSIONS

A. What is a Runway Incursion?

The 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 the loss of separation with an aircraft taking off, intending to takeoff, landing, or intending to land.” The term “loss of separation” means that the aircraft and objects involved were closer together than allowed by air traffic control (ATC) requirements. According to the FAA, if an aircraft within one mile of landing is forced to abort the approach due to an aircraft, vehicle, or pedestrian on the runway, the event will be classified as a runway incursion.

A “surface incident” is a less serious event that involves a violation of Federal Aviation Regulations (FARs), but does not result in a collision hazard or a loss of separation. For example, if an aircraft or vehicle entered a runway without ATC’s permission,

---

5 The FAA’s current website devoted to runway safety is located at http://www.faaarsp.org (last visited Apr. 15, 2002).
5 Id.
but there was no risk of collision, the FAA would classify the event as a surface incident.\(^8\)

In layman’s terms, a runway incursion occurs if an aircraft comes too close to another aircraft, vehicle, or pedestrian during the critical take-off and landing phases of flight. Based on the FAA’s broad definition, a runway incursion includes both collisions and “near-misses.” The FAA notes that most runway incursions are caused by human error rather than equipment failure.\(^9\)

Interestingly, the FAA’s definition of runway incursion applies only to airports with operating control towers.\(^10\) However, only a small percentage of U.S. airports have operating control towers. It is unclear why the FAA limits its runway incursion definition to control tower airports, but it is probable that this limitation may arise from the fact that data is easier to obtain from airports with more formalized control and safety structures. Also, the severity of runway incursions at controlled airports, where the vast majority of air carrier activity occurs, is greater due to the potential risk to life of a single collision between commercial air carrier aircraft. As such, the FAA may be focusing its data collection efforts on those airports that pose the greatest danger to the flying public.

**B. Causes of Runway Incursions**

The FAA has divided the causes of runway incursions into four broad categories: (1) Pilot Deviations; (2) Operational Errors; (3) Operational Deviations; and (4) Vehicle/Pedestrian Deviations.\(^11\)

1. **Pilot Deviations (PD)**

A Pilot Deviation is an action taken by a pilot that violates the FARs.\(^12\) For example, a pilot may taxi onto an active runway without obtaining the proper clearance from ATC. There are

---

\(^8\) See Runway Incursion Corner, *supra* note 6.


\(^10\) See *id*.

\(^11\) *SAFETY STATISTICS HANDBOOK, supra* note 4.

\(^12\) *Id*.
currently over 635,000 registered pilots in the United States,\textsuperscript{13} any of whom may be involved in a runway incursion. Furthermore, over 225,000 aircraft are registered in the United States.\textsuperscript{14} Since the FAA began taking runway incursion data in 1988, Pilot Deviations accounted for approximately 48\% of all runway incursions.\textsuperscript{15} In recent years, Pilot Deviations have risen to account for approximately 60\% of all runway incursions.\textsuperscript{16}

2. **Operational Errors / Deviations (OED)**

An Operational Error is an occurrence attributable to ATC that either results in a loss of separation distance between an aircraft and another object or causes an aircraft to land on a closed runway.\textsuperscript{17} Any air traffic controller can be involved in a runway incursion. There are approximately 15,000 air traffic controllers in the United States.\textsuperscript{18}

A clear example of Operational Error is a 1991 accident at the Los Angeles International Airport where the air traffic controller directed a commuter aircraft to taxi into position on the active runway and then cleared another aircraft to land on the same runway, resulting in a fatal collision.\textsuperscript{19}

Operational Deviations, by contrast, occur when the minimum required separation distance is maintained between the aircraft and other objects, but an ATC facility causes an aircraft to enter (or come close to entering) airspace under the control of another ATC facility without prior approval.\textsuperscript{20} Since the FAA began taking runway incursion data in 1988, Operational Errors/Deviations accounted for approximately 31\% of all runway incursions.\textsuperscript{21}

\textsuperscript{13} Aircraft Owners and Pilots Ass'n, Active Certified Pilots – Table (Dec. 31, 1999), at http://www.aopa.org/whatsnew/stats/fctcrd01.html.
\textsuperscript{14} Id.
\textsuperscript{15} Data derived from Table I, \textit{infra} Part II.C.
\textsuperscript{16} Id.
\textsuperscript{17} SAFETY STATISTICS HANDBOOK, \textit{supra} note 4.
\textsuperscript{20} SAFETY STATISTICS HANDBOOK, \textit{supra} note 4.
\textsuperscript{21} Data derived from Table I, \textit{infra} Part II.C.
3. Vehicle Operator/Pedestrian Deviations (VPD)

Vehicle and Pedestrian Deviations result from a "vehicle operator, non-pilot operator of an aircraft, or pedestrian who deviates onto the [airport surface] movement area (including the runway) without ATC authorization." As many air travelers have seen, the runways and taxiways of an airport are crowded with aircraft, as well as vehicles and personnel. Collision risk is inherent in this type of environment. Since the FAA began taking runway incursion data in 1988, Vehicle and Pedestrian Deviations accounted for approximately 21% of all runway incursions.23

C. The Increasing Risk of Runway Incursions

1. A Decades-Old Problem

Ground collisions between aircraft and other aircraft or ground objects have been documented as early as 1929.24 The following examples illustrate historic, worldwide events that would be classified as runway incursions under the current FAA definition:

- In 1977, 583 people were killed when two Boeing 747s collided on a fog-shrouded runway at the Tenerife airport in the Canary Islands. One aircraft attempted to take-off in the fog as another aircraft was taxing down the same runway in the opposite direction.25
- In 1983, two commercial airliners collided on the runway in Madrid, Spain, killing 100 people.26
- In 1984, the pilot of a small business jet made an early take-off to avoid hitting a DC-9 that had taxied onto the runway. The business jet passed just ten feet over the commercial airliner.27

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22 SAFETY STATISTICS HANDBOOK, supra note 4.
23 Data derived from Table I, infra Part II.(C).
24 See Greunke v. N. Am. Airways Co., 230 N.W. 618 (Wis. 1930) (lawsuit arising from collision between landing aircraft and aircraft parked on runway).
26 Increasing Number of Aircraft Mishaps on Our Nation’s Runways: Hearing Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, U.S. House of Representatives, 105th Cong. (Nov. 13, 1997) (testimony of Honorable Jim Hall, Chairman, National Transportation Safety Board) (transcript available at http://avweb.com/other/hall9746.html) [hereinafter Hall Testimony].
In 1988, the pilot of a small, single engine aircraft was forced to abort a landing at an uncontrolled airport when a construction vehicle pulled onto the runway as the aircraft was descending for its final approach.\(^{28}\)

In 1990, eight people died and thirty-six were injured when a Boeing 727 and a DC-9, both operated by Northwest Airlines, collided on a fog-covered runway in Detroit, Michigan.\(^{29}\)

In 1990, one person was killed in Atlanta, Georgia, when a Boeing 727 landed and collided with a small, twin-engine aircraft that had not taxied clear of the runway.\(^{30}\)

In 1991, thirty-four people were killed when a Boeing 737 landed and collided with a commuter aircraft stopped on the runway at the Los Angeles International Airport.\(^{31}\)

In 1994, the occupants of a small twin-engine aircraft were killed when the aircraft taxied into the path of a DC-9 landing on the same runway in St. Louis, Missouri.\(^{32}\)

In 1996, a twin-engine business aircraft taxied onto a runway at an uncontrolled airport in Quincy, Illinois as a commuter aircraft was landing, killing fourteen people.\(^{33}\)

In 1999, four separate incidents occurred (two at Chicago O’Hare, one at Los Angeles, one at JFK in New York) in which a commercial airliner on take-off flew within 300 feet of another commercial airliner that had taxied onto the runway.\(^{34}\)

---

28 The author of this article was piloting the aircraft while building flight hours towards a Private Pilot’s License.


30 NTSB, SAFETY RECOMMENDATION A-00-66/-71, 1 (July 6, 2000) [hereinafter SAFETY RECOMMENDATION].

31 LAX Accident, supra note 19.


In March 1999, four people were killed when two single-engine private aircraft collided on a runway in Sarasota, Florida.  

On October 31, 2000, a Singapore Airlines B-747 took off at night in a typhoon on a closed runway in Taiwan and collided with construction equipment, killing eighty-two people.  

Clearly, the above list is not entirely inclusive, but it gives a clear picture of the catastrophic results that runway incursions can have for the flying public, the federal aviation authorities, and aircraft owners and operators.

2. Recognizing A Dangerous Trend

Over the last decade, the reduction of runway incursions has been a fixture on the National Transportation Safety Board’s (NTSB) “Most Wanted” list of aviation safety improvements. However, over that same time period, runway incursions have actually increased disproportionately to the increase in airport operations. Table I shows the statistical rise in runway incursions since the FAA began tracking the data in 1988.

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37 SAFETY RECOMMENDATION, supra note 30, at 2.
38 As used in this article, “airport operations” refers to the total annual number of take-offs and landings at U.S. airports with operating control towers.
TABLE I:
FAA RUNWAY INCURSION DATA — 1988 TO 2000

<table>
<thead>
<tr>
<th>Year</th>
<th>Runway Incursions</th>
<th>Total Airport Operations</th>
<th>Total Runway Incursion Rate (per 100,000 operations)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total PD OED VPD</td>
<td>Yearly Total % Change*</td>
<td>Rate % Change*</td>
</tr>
<tr>
<td>1988</td>
<td>187 68 89 30</td>
<td>62,501,059 —</td>
<td>0.30 —</td>
</tr>
<tr>
<td>1989</td>
<td>223 83 80 60</td>
<td>62,625,548 0.2%</td>
<td>0.36 20.0%</td>
</tr>
<tr>
<td>1990</td>
<td>281 119 100 62</td>
<td>65,506,291 4.6%</td>
<td>0.43 19.4%</td>
</tr>
<tr>
<td>1991</td>
<td>242 102 74 66</td>
<td>62,421,635 —4.7%</td>
<td>0.39 —9.3%</td>
</tr>
<tr>
<td>1992</td>
<td>219 92 90 37</td>
<td>63,018,680 1.0%</td>
<td>0.35 —10.3%</td>
</tr>
<tr>
<td>1993</td>
<td>186 84 74 28</td>
<td>61,946,482 —1.7%</td>
<td>0.30 —14.3%</td>
</tr>
<tr>
<td>1994</td>
<td>200 66 83 51</td>
<td>62,452,572 0.8%</td>
<td>0.32 6.7%</td>
</tr>
<tr>
<td>1995</td>
<td>240 125 65 50</td>
<td>62,074,306 —0.6%</td>
<td>0.39 21.9%</td>
</tr>
<tr>
<td>1996</td>
<td>275 146 69 60</td>
<td>61,817,425 —0.4%</td>
<td>0.44 12.8%</td>
</tr>
<tr>
<td>1997</td>
<td>292 132 87 73</td>
<td>64,440,947 4.2%</td>
<td>0.45 —2.2%</td>
</tr>
<tr>
<td>1998</td>
<td>325 183 91 51</td>
<td>66,211,734 2.7%</td>
<td>0.49 8.9%</td>
</tr>
<tr>
<td>1999</td>
<td>321 182 78 61</td>
<td>68,672,240 3.7%</td>
<td>0.47 —4.1%</td>
</tr>
<tr>
<td>2000</td>
<td>431 259 87 85</td>
<td>67,480,097 —1.7%</td>
<td>0.64 36.2%</td>
</tr>
</tbody>
</table>

* Compared to the previous year.

The critical number in Table I is the Total Runway Incursion Rate (TRIR). The TRIR is the rate of runway incursions (both collisions and near-misses) per 100,000 airport operations. A comparison of FAA data from 1988 to 2000 shows disproportionate yearly changes in TRIR compared with total airport operations. For example, from 1993 to 2000, the total number of airport operations increased approximately 9%, while the TRIR increased over 113%.40 It is also important to note that the total number of runway incursions increased almost 132% for the same time period. An analysis by Air Line Pilot Magazine indicated that the risk of runway incursions grows exponentially as a function of increased airport operations.41 The FAA predicts

40 Data derived from Table I.

A cursory analysis of the data in Table I shows nearly a 15% increase in runway incursions for every 1% increase in airport operations based on historical data from 1993 to 2000. A complex statistical analysis is beyond the scope of this article, so the relationship between airport operations and runway incursions is assumed to be linear for simplicity. However, there is some evidence that the number of runway incursions is not proportional to the number of airport operations. For example, the FAA’s historical data shows that the total number of airport operations for 1993 and 1996 varied by only 0.2%, while the number of runway incursions for 1993 and 1996 increased by 48%. In addition, between
that the total number of airport operations at airports with control towers will increase as much as 24% between 1999 and 2010.\textsuperscript{42} If the current trend in runway safety continues, the expected rise in airport operations in the next decade could lead to a dramatic rise in runway incursions, with the potential for more than five runway incursions per day.\textsuperscript{43} Perhaps the most dramatic statistic is that the total number of runway incursions exceeded the total number of reported near mid-air collisions for each year from 1995 to 1999\textsuperscript{44}—a clear indication that runway incursions pose a serious threat to air travel. In fact, Professor Arnold Barnett of the Massachusetts Institute of Technology indicated that deaths resulting from runway incursions could surpass deaths from all other types of aviation accidents combined within the next twenty years unless action is taken to reduce runway incursion risk.\textsuperscript{45} In research conducted under contract with the FAA, Professor Barnett concluded that approximately 15 fatal runway collisions, resulting in nearly 1,000 deaths and injuries, could occur annually at U.S. airports by 2022.\textsuperscript{46}

Interestingly, runway incursions do not occur in a uniform manner across all of the U.S. airports included in the FAA’s statistics (those with control towers). In fact, 18% of all runway

\textsuperscript{42} SAFETY RECOMMENDATION, supra note 30, at 2.

\textsuperscript{43} Assuming a linear relationship between total airport operations and the number of runway incursions (a 15% increase in runway incursions for every 1% increase in airport operations), a 24% increase in airport operations from 2000 through 2010 would lead to a 360% increase in runway incursions if current trends are not reversed. This means that by 2010, there is the possibility that the United States may experience as many as 1,983 runway incursions annually (nearly 5.5 per day) during as many as 83,675,320 airport operations for a TRIR of 2.37.

\textsuperscript{44} The total number of reported near mid-air collisions for each year is: 238 (1995); 194 (1996); 238 (1997); 208 (1998); and 252 (1999). See SAFETY STATISTICS HANDBOOK, supra note 4, at 1-1.


incursions between 1997 and 2000 occurred at only 2% of the airports included in FAA statistics.\(^{47}\)

3. Underestimating the True Scope of the Danger

It is crucial to remember that the FAA's data only includes runway incursions occurring at airports with operating control towers,\(^{48}\) although an event meeting the FAA's definition of a runway incursion can occur at any airport no matter how large or small.\(^{49}\) There are many "uncontrolled" airports in the United States that do not have control towers. These are usually small, rural airports with much less traffic than urban facilities with control towers. The risk of a runway incursion at uncontrolled airports poses no less of a threat to the flying public than at an airport with an operating control tower.

According to a recent FAA report, there were approximately 459 operational control towers in the United States as of 2000, representing over 180,000 airport operations (take-offs and landings) per day.\(^{50}\) In contrast, there are over 13,600 airports in the United States.\(^{51}\) As such, nearly 13,100 airports (96% of all airports in the U.S.) are excluded from the FAA's runway incursion statistics. Since FAA statistics only include incursions at approximately 4% of all U.S. airports, the true scope of the danger may be grossly underestimated.

Furthermore, according to the National Aeronautics and Space Administration's (NASA) Aviation Safety Reporting System (ASRS) data, for every event that meets the FAA's definition of a runway incursion, three unauthorized runway crossings ("surface incidents") occur that would have been runway incursions had another aircraft, vehicle, person, or object been within

\(^{47}\) The top ten airports with the most runway incursions between 1997 and 2000 are: (1) Los Angeles - 33 incursions; (2) St. Louis - 30 incursions; (3) Orange County, California - 27 incursions; (4) North Las Vegas - 26 incursions; (5) Long Beach, California - 25 incursions; (6) Dallas-Fort Worth - 23 incursions; (7) San Francisco - 21 incursions; (8) San Diego/Montgomery Field - 20 incursions; (9) Fort Lauderdale, Florida - 20 incursions; and (10) Phoenix - 18 incursions. Hearing on Runway Incursions, Focusing on Technology to Prevent Collisions Before the House Subcomm. on Aviation, 107th Cong. (2001) (transcript available at http://www.house.gov/transportation/aviation/06-26-01/06-26-01memo.html) [hereinafter Technology Testimony].

\(^{48}\) See supra note 10 and accompanying text.

\(^{49}\) See, e.g., supra notes 28 and 33 and accompanying text.

\(^{50}\) See Runway Incursion Severity Report, supra note 18, at 5, 13.

the requisite minimum distance allowed between the aircraft taking-off or landing on the runway.\textsuperscript{52}

Finally, it is worth noting that the FAA's data only includes those runway incursions that are actually reported. It is highly likely that many runway incursions go unreported every year because pilots and air traffic controllers may not realize that a runway incursion has occurred. The FAA's efforts to increase awareness of runway incursion occurrences are discussed later in this article.\textsuperscript{53}

D. PILOT DEVIATIONS – A SIGNIFICANT DANGER

In the 1990s, Pilot Deviations accounted for nearly 50\% of all runway incursions.\textsuperscript{54} By 2000, the contribution of Pilot Deviations was approximately 60\%.\textsuperscript{55} Runway incursions can involve all types of aircraft operated by flight crews with varying degrees of experience. The Inspector General of the Department of Transportation (DOT/IG) stated that General Aviation (small, noncommercial aircraft normally operated by pilots with less experience than air carrier pilots) is responsible for approximately 72\% of all runway incursions, while being involved in only 59\% of total airport operations.\textsuperscript{56} The DOT/IG noted, however, that runway incursions that cause actual accidents (collisions) predominantly involve commercial airline aircraft.\textsuperscript{57} The explanation for this may be found in the nature of general aviation operations. Most general aviation flights are conducted during daylight hours in good visibility when the environmental factors that contribute to collision risk are low. The nature of commercial air carrier operations requires that the pilots fly at night and in poor visibility\textsuperscript{58} – factors which can greatly increase the risk of ground collisions. Furthermore, most general aviation operations occur at smaller airports where there is less traffic congestion.

According to the Airplane Owners and Pilots Association ("AOPA"), private pilots (generally, those with the least flight

\textsuperscript{52} Lounsbury, supra note 41.
\textsuperscript{53} See infra Part VI.
\textsuperscript{54} Data derived from Table I, supra Part II.(C).
\textsuperscript{55} See id.
\textsuperscript{57} Id.
\textsuperscript{58} Id.
experience) account for 33% of all Pilot Deviations, while Airline Transport Pilots (ATPs—those with the most flight experience) contribute to 30% of all Pilot Deviations. Furthermore, pilots with more than 10,000 hours of flight experience are responsible for 18% of all Pilot Deviations. Pilots with fewer than 300 hours of flight experience are involved in 22% of all Pilot Deviations. This makes it clear that pilots of all experiences levels need to be aware of the persistent dangers in aircraft ground operations.

E. OTHER FACTORS THAT AFFECT RUNWAY SAFETY

In addition to the factors listed above, airport layout, aircraft design, and potentially dangerous ATC procedures can greatly increase the chances of a runway incursion.

1. Next Generation Aircraft Design

Current developments in aircraft design could potentially lead to increased runway incursions with greater risk to passengers and crew. Many aircraft manufacturers are currently developing ultra-high capacity aircraft. The large size of these aircraft can lead to more congestion in airport ground operations and difficulty in maneuvering to avoid obstacles. In addition, these aircraft are being designed to carry more passengers than the largest aircraft in service today. In the event of a runway incursion, many more lives would be put at risk due to the high seating capacity. An event such as Tenerife, involving new, high-capacity airliners, would create an aviation tragedy not soon forgotten.

2. Airport Planning and Design

The design of an airport can increase the risk of runway incursions. Just as an intersection on a city street is ripe for collisions, intersections on taxiways and runways at airports are also fre-

60 Id.
61 Id.
62 See Rodney Fewings, Ultra-High Capacity Aircraft Will Intensify Airport Safety Issues, AIRPORT OPERATIONS 21, Jan-Feb 1995, at 1, 3. See also MEAD TESTIMONY, supra note 9, at 6 (stating that airport design can be a factor in runway incursions).
63 See Fewings, supra note 62.
quent locations of runway incursions. Airport lighting and the
distance of the control tower from the runway can also have an
impact on air traffic control’s ability to direct aircraft away from
each other.\textsuperscript{64} Airport safety improvements will be discussed
later in this article.\textsuperscript{65}

3. A Risky ATC Procedure – Playing “Chicken” With Commercial
Airliners

A current ATC procedure has the potential to force a runway
incursion to occur. The procedure, known as Land and Hold
Short Operations (LAHSO), essentially takes two aircraft that
are taxiing or landing on intersecting runways and directs them
towards each other.\textsuperscript{66} In theory, one of the aircraft will stop
short of the intersection (at the direction of ATC) with the
other runway or taxiway and let the other aircraft pass safely.\textsuperscript{67}
The FAA intends for the LAHSO procedure to increase airport
capacity for take-offs and landings without compromising
safety.\textsuperscript{68} The Air Line Pilots Association (ALPA) has endorsed
LAHSO based, in part, on the following guarantees by the FAA:
(1) LAHSO will not be conducted on wet runways since landing
and braking distances are difficult to anticipate; (2) runways
must have appropriate markings and lighting; and (3) LAHSO
is only to be performed by pilots trained in the procedure.\textsuperscript{69}
Undoubtedly, ATC and pilots will conduct LAHSO in the safest
manner possible to avoid disaster. However, placing aircraft on
a collision course in the hopes that the ATC system, aircraft, and
pilots all perform flawlessly is a dangerous proposition when
data shows that aircraft collide with each other on the ground at
an increasing rate due to errors by ATC and pilots.

\textsuperscript{64} These concerns were noted as contributing factors in the St. Louis runway
collision. \textit{See St. Louis Accident, supra note 32.}

\textsuperscript{65} \textit{See infra Part III.}

\textsuperscript{66} News Release, Air Line Pilots Ass’n, ALPA Issues Statement on LAHSO Concerns

\textsuperscript{67} \textit{See id.}

\textsuperscript{68} \textit{See FAA, Land and Hold Short Operations: A Primer, at \url{http://www.faa.gov/avr/news/lahso.htm} (last visited Apr. 15, 2002).}

\textsuperscript{69} Duane Woerth, Air Line Pilots Ass’n, \textit{Our LAHSO Success Belongs to You . . .
The ALPA Pilot, at \url{http://www.alpa.org/internet/projects/lahso/cj8dw.htm} (last
visited Apr. 15, 2002).}
III. USING TECHNOLOGY TO ENHANCE RUNWAY SAFETY

Human beings are involved in all aspects of airport operations. Pilots and controllers guide the aircraft through a maze of concrete ramps, runways, and taxiways on the airport surface. Ground crew, service personnel, and airport construction workers are also active in the airport environment. With so much human interaction in the aviation system, human error is a safety concern that will always be present. This is especially true in the airport ground environment where people are forced to work at their various duties on a confined slab of concrete. Technological solutions to the runway incursion problem fill the safety gaps caused by the inevitable existence of human error.

A. HIGH-TECHNOLOGY SOLUTIONS

1. Radar and Satellite Surveillance Systems

The primary technological focus in the effort to reduce runway incursions is in the development of radar systems that will detect aircraft and vehicles on the airport surface. The primary system is called Airport Surface Detection Equipment (ASDE-3). ASDE-3 is designed to provide radar coverage of aircraft and vehicles on the airport surface at airports with a high density of surface activity. The radar data provided by the ASDE-3 system is intended to aid controllers in the movement of aircraft and vehicles on the airport surface when visibility is reduced due to rain, fog, darkness, and other environmental factors. ASDE-3 is currently in use at thirty-three of the nation’s busiest airports.

ASDE-X is a lower-cost alternative system similar to ASDE-3, but intended for airports with a lower level of surface activity such that the capabilities of ASDE-3 are not required. Currently, twenty-five airports are scheduled to receive the ASDE-X system. Notably, the Oslo, Norway, airport utilizes a sophisti-
cated runway surface surveillance radar system which airport officials claim has virtually eliminated runway incursions.\textsuperscript{75}

A supplemental computer system called the Airport Movement Area Safety System (AMASS) works with ASDE-3 and ASDE-X to provide air and ground traffic controllers with visual and aural warnings of impending surface collisions.\textsuperscript{76} However, the effectiveness of the AMASS system has come in question after a runway incursion at Chicago O'Hare airport in 1999 where two 747 jumbo jets nearly collided.\textsuperscript{77} The AMASS system was not operational at O'Hare at the time of the incursion, but a computer analysis by the FAA showed that AMASS would only have given traffic controllers a six-second advanced warning of the impending collision – not nearly enough time to warn and stop two jumbo jets.\textsuperscript{78} Still, the FAA plans to have AMASS systems installed at airports equipped with ASDE-3 by late 2002.\textsuperscript{79} However, that target date may be difficult to achieve as both the ASDE-3 and AMASS programs have a history of cost overruns and schedule delays.\textsuperscript{80}

A system similar to ASDE is called Automatic Dependent Surveillance-Broadcast (ADS-B). The ADS-B system transmits and receives signals via satellite.\textsuperscript{81} A Global Positioning System (GPS) then locates the position of the signal and provides that positioning data to computers, which can generate a display of the target’s position on the airport surface.\textsuperscript{82} The United Parcel Service (UPS) recently announced plans to install ADS-B systems in 230 of its cargo aircraft.\textsuperscript{83} Various cockpit displays, including Heads-Up Displays (HUDs), are being developed to display the data provided by the ADS-B system to the pilots of aircraft equipped to receive the information.\textsuperscript{84} These display

\textsuperscript{75} "Simple Things" Needed to Prevent Near Misses at Airports, \textit{Air Safety Week}, June 19, 2000, at 3.

\textsuperscript{76} \textit{AIRWise News}, supra note 73. It is interesting to note that only six of the ten airports with the most runway incursions (\textit{supra} note 47) are scheduled to receive either AMASS or ASDE-X. \textit{See also Technology Testimony, supra note 47, at 4.}

\textsuperscript{77} \textit{See Ferguson, supra note 41. See also supra note 34 and accompanying text.}

\textsuperscript{78} \textit{See Ferguson, supra note 41.}

\textsuperscript{79} \textit{AIRWise News, supra note 73.}

\textsuperscript{80} \textit{See infra Part V.(C).}

\textsuperscript{81} James Ott, \textit{ADS-B Stirs FAA Certification Plans, Aviation Week & Space Tech.}, Nov. 6, 2000, at 45.

\textsuperscript{82} Id.

\textsuperscript{83} FAA Certifies ADS-B For Transport Jets, \textit{supra} note 45.

systems allow pilots to “see” collision threats without having to rely on warnings from controllers.

2. **Loop Technology Surveillance Systems**

“Loop” technology (LOT) is currently used at many automobile traffic intersections around the world. The airport version of the LOT system consists of electrically inductive coils buried in the runway or taxiway. The buried coils set up an electrical field that is cut by the metallic structure of an aircraft or vehicle as it passes over the loop. This creates an electrical current in the loop that is a function of the size of the metallic object passing over the loop and the height of that object above the concrete surface. A computer system can then analyze the electrical current created by the passing vehicle or aircraft and inform the air and ground controllers not only of the presence of the object on the airport surface, but also of the size or type of object (for example, a Boeing 747 aircraft versus a fuel truck). The LOT system has the ability to monitor a small section of the airport and, as such, is a possible alternative for airports that do not have the heavy ground traffic density that would require ASDE-3 or ASDE-X systems. The United States Air Force has partnered with a private engineering company to develop a LOT system called the Ground Safety Tracking and Reporting System (GSTARS). The Munich, Germany, airport utilizes LOT technology which airport officials claim has virtually eliminated runway incursions.

### B. Low-Technology Solutions

In addition to expensive high-technology devices, simple, low technology efforts may aid in reducing runway incursions.

#### 1. Airport Lighting

Runways and taxiways are lighted in different colors so that pilots are able to distinguish between surfaces. The FAA has de-

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86 Id. at 1.
87 Id.
88 Id. at 3.
89 Id. at 1.
90 *Program Enhances Airport Ground Safety*, R & D MAGAZINE, Sept. 1, 2000, at 1.
91 “Simple Things” Needed to Prevent Near Misses at Airports, *supra* note 75, at 3.
veloped Runway Safety Lights (RWSL), also called “stop bar” lights, as an added safety feature in an effort to prevent runway incursions. The RWSL system comprises a set of radar-based, automated runway status lights that illuminate in red when it is unsafe for an aircraft to enter a runway or proceed with a takeoff due to interfering aircraft or vehicle traffic. These lights would be used in addition to other runway and taxiway lights that denote the boundaries and centerlines of the runway and taxiway surfaces. London’s Heathrow airport uses a “stop bar” light system and airport officials claim that runway incursions rarely occur.

Another type of airport lighting system involves using laser light to project stopping lines on the surface of runways or taxiways. The FAA has entered into a research and development agreement with an Alaskan company to further develop the laser light system.

2. Airport Signage and Markings

Airport signs use a color convention to convey important information to pilots and ground vehicle operators. A red sign with white letters indicates that an aircraft is approaching a runway. A black sign with a yellow frame and yellow letters indicates the name of a taxiway or runway that the aircraft or vehicle is currently operating on. Yellow signs with black letters are used to provide directions to aircraft and ground vehicles on how to proceed to a desired location on the airport surface. Increasing the prominence of airport signage could aid in decreasing runway incursions by enhancing the situational awareness of both pilots and vehicle operators.

A current FAA runway safety initiative calls for the improvement of runway surface markings. The yellow “hold lines,”

93 Id.
94 “Simple Things” Needed to Prevent Near Misses at Airports, supra note 75, at 3.
96 See id.
98 Id.
99 Id.
which show a pilot where to stop when approaching a runway intersection, are to be increased in size from a six-inch width to a twelve-inch width to increase visibility to pilots and vehicle operators.\textsuperscript{101}

Another type of surface marking involves the use of "rumble strips" embedded in the runway or taxiway surface, similar to those used on automobile roadways.\textsuperscript{102} This device is intended to warn a pilot that the aircraft is approaching the entrance to a runway.\textsuperscript{103} However, rumble strips have limited effectiveness. This is due to the fact that a fixed-size rumble strip would have a different effect on different size aircraft or vehicles. For example, a rumble strip designed to warn the flight crew of a 747 would have to be so large that it could do serious damage to small, private aircraft.\textsuperscript{104}

3. Airport Design

As discussed above, the design of the airport surface can lead to an increased risk of runway incursions.\textsuperscript{105} Three recent runway incursions at New York's LaGuardia airport clearly demonstrate that runway design can increase the risk of runway incursions. All three incidents involved large commercial passenger aircraft passing close to each other at the intersection point of two runways.\textsuperscript{106} Clearly, airport designs that minimize runway intersections can aid in the reduction of the potential for runway incursions. The Oslo, Norway and Munich, Germany airports were designed to minimize the amount of traffic crossing the runways.\textsuperscript{107} Furthermore, both of these airports are designed such that maintenance roads circumvent runways.\textsuperscript{108}

\textsuperscript{101 Id.  \\
\textsuperscript{102 Ferguson, supra note 41.  \\
\textsuperscript{103 Id.  \\
\textsuperscript{104 Id.  \\
\textsuperscript{105 See supra Part II.(E).  \\
\textsuperscript{106 See Frances Fiorino, Runway Mix a Factor in LaGuardia Incidents, AVIATION WEEK & SPACE TECH., June 26, 2000, at 72.  \\
\textsuperscript{107 "Simple Things" Needed to Prevent Near Misses at Airports, supra note 75, at 3. The Oslo and the Munich airports have parallel runways with almost all ramps and taxiways located between the runways so that nearly all taxi routes avoid crossing the runways. See Methods of Preventing Runway Collisions Evolve in Europe and the United States, AIRPORT OPERATIONS 26, July – Aug. 2000, at 4 (hereinafter Methods of Preventing Runway Collisions).  \\
\textsuperscript{108 Methods of Preventing Runway Collisions, supra note 107, at 4.}
Officials at these European airports indicate that runway incursions are minimal. 109

Low-technology solutions have provided a significant reduction in runway incursions at the Cleveland Hopkins International Airport in Ohio. Cleveland Hopkins once had the highest number of runway incursions in the country. 110 In an effort to reduce the number of runway incursions, the airport painted wider “hold” lines, installed improved runway and taxiway lighting, installed “stop bar” lights at the entrance to one runway, closed a confusing taxiway, and color-coded taxiway routes for pilots. 111 Between October 1999 and October 2000, Cleveland Hopkins airport had only one runway incursion, compared with nineteen incursions in 1996 112— a clear example that low-tech solutions can be effective at reducing the number of runway incursions.

IV. REDUCING HUMAN ERROR

Technological solutions to runway incursions are slow to develop and can be costly to implement. A quicker, less expensive parallel solution must be found to reduce the number of runway incursions at U.S. airports. As such, the FAA has determined that reducing human error in controllers, pilots, and airport vehicle operators is critical to reducing runway incursions. Human error will always be present in aviation, but reducing the occurrence of human error will go a long way to improving runway safety.

A. REDUCING CONTROLLER ERROR

The FAA recognizes Operational Errors and Deviations as contributing factors to runway incursions. As stated previously, controller errors account for approximately one-third of all runway incursions. 113 In times of low visibility, when the risk of runway incursions is particularly high, pilots must rely on air and ground traffic controllers to guide aircraft around the airport surface. Controllers are capable of making mistakes even with access to the best traffic control technology. It is imperative to

109 Id.
110 Ferguson, supra note 41.
111 Id.
112 Id.
113 See supra Part II.B.
reduce controller mistakes in order to reduce runway incursions.

The FAA's newest safety initiatives focusing on reducing controller error are discussed later in this article. The current commitment to reducing controller error focuses on education and training and improving a controller's situational awareness. Training courses and materials can educate a controller on the efficient movement of airport ground and air traffic. Controllers work in a fast-paced, high stress environment. They must operate at peak mental efficiency to effectively and safely move aircraft and vehicles on the airport surface. A recent study conducted by the Flight Safety Foundation found that air traffic controllers who took short naps during simulated work shifts displayed greater mental alertness. Improved training and increased mental alertness are imperative to reducing controller mistakes.

B. Reducing Vehicle Operator and Pedestrian Error

Pedestrian and Vehicle Operator Deviations account for approximately one-fifth of all runway incursions. Once again, the FAA has recognized that increased training, education, and situational awareness are imperative to reducing these errors. Airport vehicle drivers have access to booklets, pamphlets, and training videos that educate on the safe operation of vehicles in an airport environment.

The Code of Federal Regulations (CFRs) for Aeronautics and Space specifically states that airport operators must establish and implement procedures for the operation of vehicles on the airport surface. Airfield driver training is not specifically required by the FARs, but most airports now provide some form of driver training for people who require vehicle access to the airport surface area. As with controllers and pilots, situational

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114 See infra Part VI.
115 See id.
117 See supra Part II.(B).
118 See infra Part VI.
120 14 C.F.R. § 139.329(b) (2000).
121 Airfield Driver Training, supra note 119, at 2-3.
awareness in the airport environment is crucial to the reduction of vehicle operator errors.

C. REDUCING PILOT ERROR

From 1988 to the late 1990s, Pilot Deviations accounted for nearly half of all runway incursions at U.S. airports.\(^\text{122}\) In recent years, Pilot Deviations have risen to account for as many as 60\% of all runway incursions.\(^\text{123}\) As such, reducing pilot error is perhaps the most critical factor in reducing runway incursions. The FAA’s newest safety initiatives focusing on reducing pilot error are discussed later in this article.\(^\text{124}\) The current commitment to reducing pilot error focuses on pilot education and training as well as improving a pilot’s awareness of the airport situation and the pilot’s communication with controllers.\(^\text{125}\)

In addition to training and education programs offered by the FAA and other aviation authorities, pilots can prevent runway incursions by following simple tenets of safe operation on the airport surface:\(^\text{126}\)

- Review airport diagrams to become familiar with runway and taxiway orientation.
- Know and understand airport signage and lighting.
- After receiving controller instructions to “cross” or “hold-short” of runways or taxiways, read back those instructions to the controllers to confirm a correct understanding.\(^\text{127}\)
- Review the Notices to Airmen (NOTAMs) for the specific airport to obtain information on runway and taxiway closures or construction areas.
- When unsure of the route of taxi, contact the controller and request progressive taxi instructions.
- Check for aircraft and vehicle traffic prior to crossing or entering any taxiway or runway.

\(^{122}\) See supra Part II.(B).
\(^{123}\) See supra note 16 and accompanying text.
\(^{124}\) See infra Part VI.
\(^{125}\) See id.
\(^{127}\) As part of the FAA’s Runway Safety Program, many regional workshops were conducted to educate pilots and controllers. As a part of these workshops, recommendations were issued which included revising 14 C.F.R. § 91.129(i) to require pilots to obtain controller clearance prior to crossing any runway. See FAA, National Runway Safety Summit, at http://www.faarsp.com/summitmain.htm (last visited Apr. 15, 2002). See also 14 C.F.R. § 91.129(i) (2000).
• Turn on aircraft lights while taxiing to provide greater visibility to controllers, vehicle operators, and other pilots.
• After landing, clear the runway as soon as feasible and then contact the controller for taxi instructions prior to any movement on the taxiway.
• Use and understand the proper aviation terminology and phraseology when communicating with controllers.

V. THE FAA’S FAILED ATTEMPTS TO PREVENT RUNWAY INCURSIONS

A. The 1980s — Initial Attempts To Improve Safety Fall Short

As a result of several ground collisions and near misses in the late 1970s and early 1980s, the NTSB began a special investigation in 1985 to determine ways to reduce runway incursions.\textsuperscript{128} In 1986, the NTSB issued a report entitled “Runway Incursions at Controlled Airports in the United States” (\textit{1986 Report}) which discussed thirty-three safety recommendations aimed at reducing runway incursions.\textsuperscript{129} Of those recommendations, nineteen had been issued prior to the 1986 Report and fourteen were added by the 1986 Report.\textsuperscript{130}

The 1986 Report was critical of the FAA’s past efforts to reduce runway incursions.\textsuperscript{131} The NTSB found that the FAA had taken “unacceptable action” on seven of the nineteen existing recommendations.\textsuperscript{132} Specifically, the 1986 Report noted that the FAA was unable to provide measurable data regarding runway incursions due to incomplete reporting of events and poor follow-up investigations.\textsuperscript{133} The 1986 Report also stated that FAA tower controllers were not adequately trained to prepare them for the rigors of working in a control tower.\textsuperscript{134} The NTSB also noted that the FAA did not have “standard evaluation and re-training procedures for controllers involved in operational errors.”\textsuperscript{135}

\begin{footnotes}
\item[128] 1986 NTSB Report, supra note 27.
\item[129] Id. at 36-42.
\item[130] Id.
\item[131] Id. at 33.
\item[132] Id. at 36-42.
\item[133] 1986 NTSB Report, supra note 27, at 33.
\item[134] Id.
\item[135] Id. at 35.
\end{footnotes}
B. 1990 TO 1995 – FAA DEVELOPS RUNWAY INCURSION PLANS

At the time of the 1990 runway collision in Atlanta, the FAA had still not implemented many of the safety recommendations from the 1986 Report. Consequently, the NTSB included runway incursions on its “Most Wanted” list of transportation safety improvements.

In 1991, the FAA developed a Runway Incursion Plan (1991 Plan) that included forty-five action items to be implemented in order to reduce runway incursions. The 1991 Plan created a focal point within the FAA for coordination of the Plan between the various organizations that would be involved in the runway incursion program. In 1995, the FAA revised the 1991 Plan and released a new Runway Incursion Action Plan (1995 Plan) with the goal of reducing the number of runway incursions to forty-one (an 85% reduction from the 287 runway incursions that occurred in 1996) by the end of 2000. The 1995 Plan contained an extensive list of projects affecting the national aviation system. The projects ranged from the improvement of traffic control procedures, to the improved lighting at airports, to the purchase of advanced technologies (such as ground radar) to aid air traffic controllers in avoiding runway incursions.

Two of the technological enhancements that the FAA specifically discussed were the ASDE-3 radar system and AMASS.

C. 1997 – FAA'S 1995 RUNWAY INCURSION PLAN FOUND INEFFECTIVE

Through 1997, Congress had appropriated nearly $309 million for runway incursion projects. Despite the large government financial support, the FAA's Runway Incursion Program was making little progress. On November 13, 1997, Jim Hall, the Chairman of the NTSB, presented a critical assessment of the FAA's actions to the U.S. House of Representatives Subcommittee on Aviation. Mr. Hall stated that in 1995 the NTSB

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136 SAFETY RECOMMENDATION, supra note 30, at 1.
137 Id.
138 Mead Statement, supra note 9, at 5-6.
139 Id. at 6.
140 Id. at 1, 5.
141 Id. at 6.
142 Id.
144 See Hall Testimony, supra note 26.
issued safety recommendations that urged the FAA to form a task force to implement the recommendations to improve runway safety.\textsuperscript{145} As part of his critique, Mr. Hall pointed out:

\begin{quote}
[1]t was not until October [1997] that a roundtable discussion of the runway incursion problem was conducted. While it appears that the FAA is willing to acknowledge that there is a problem with [airport] surface operations, there does not appear to be the appropriate level of emphasis given in this area.\textsuperscript{146}
\end{quote}

At the same House Subcommittee meeting, Kenneth Mead, the DOT/IG, presented a critical assessment of the FAA’s 1995 Plan.\textsuperscript{147} Early in 1998, the DOT/IG issued an Audit Report (1998 Audit) of the FAA’s Runway Incursion Program that reiterated the content of the DOT/IG’s congressional testimony.\textsuperscript{148} The DOT/IG found that the plan was not working as designed due to a variety of causes.\textsuperscript{149} First, the DOT/IG determined that the FAA team charged with implementing and coordinating the projects listed in the 1995 Plan was never formed and no documentation was ever produced updating the status of the plan.\textsuperscript{150} The DOT/IG was particularly troubled by the fact that FAA headquarters had not discussed the 1995 Plan with its regional offices, as those offices had little knowledge of the Plan’s existence.\textsuperscript{151} Second, the DOT/IG found that runway incursion reduction programs instituted by local aviation authorities at some airports were not disclosed to the national director of the FAA’s Runway Incursion Program.\textsuperscript{152} Third, the DOT/IG determined that the 1995 Plan targeted the wrong problems areas for improvement. As mentioned above, the majority of runway incursions are caused by Pilot Deviations.\textsuperscript{153} However, the DOT/IG noted that the 1995 Plan did not include programs that were directed at reducing the number of Pilot Deviations.\textsuperscript{154}

In addition, the DOT/IG found that the FAA’s runway incursion data was not accurate because: (1) not all runway incursions were reported; (2) some runway incursions were not

\begin{itemize}
\item \textsuperscript{145} Id.
\item \textsuperscript{146} Id.
\item \textsuperscript{147} Mead Statement, supra note 9.
\item \textsuperscript{148} 1998 Audit, supra note 143.
\item \textsuperscript{149} Id. at 5-19.
\item \textsuperscript{150} Id. at 8.
\item \textsuperscript{151} Id.
\item \textsuperscript{152} Id. at 9.
\item \textsuperscript{153} See supra Part II.(D).
\item \textsuperscript{154} 1998 Audit, supra note 143, at 9.
\end{itemize}
reported properly; and (3) some runway incursion reports were not validated, including fourteen reports that were more than three years overdue.\textsuperscript{155} Finally, the DOT/IG noted that the development and installation of the FAA’s new technology (AMASS and ASDE-3) was significantly behind schedule.\textsuperscript{156} Specifically, the DOT/IG noted that both ASDE-3 and AMASS were four years behind schedule and AMASS was $14.3 million over budget.\textsuperscript{157} The DOT/IG also noted that it would be unlikely for the FAA to reach its goal of only forty-one runway incursions by the end of 2000 if the Runway Incursion Program was not improved.\textsuperscript{158} The DOT/IG made eight recommendations to improve the Runway Incursion Program, including: (1) improve FAA coordination of local, regional, and national runway incursion reduction efforts; (2) increase the focus on reducing Pilot Deviations and improving pilot education of runway incursion prevention measures; and (3) improve data collection and analysis.\textsuperscript{159} Late in 1997, the FAA agreed to implement all eight recommendations by the end of 1998.\textsuperscript{160} Despite the poor results of the previous Runway Incursion Plans, Congress designated $21.8 million for runway incursion programs in Fiscal Year 1998.\textsuperscript{161}


As a result of the DOT/IG’s critical assessment of the FAA’s efforts to reduce runway incursions, the FAA’s Research, Engineering, and Development Advisory Committee endorsed the DOT/IG’s recommendations for improvement and added its own recommendations.\textsuperscript{162} The result was the development of the FAA’s 1998 Airport Surface Operations Safety Action Plan.

\textsuperscript{155} \textit{Id.} at 14.
\textsuperscript{156} \textit{Id.} at 15.
\textsuperscript{157} \textit{Id.} By May 29, 2001, the date when the FAA officially approved the AMASS system for installation at U.S airports, the AMASS program was six years behind schedule and approximately 154% over budget. \textit{See Technology Testimony, supra} note 47, at 6.
\textsuperscript{158} \textit{Mead Statement, supra} note 9, at 1.
\textsuperscript{159} \textit{1998 Audit, supra} note 143, at 20.
\textsuperscript{160} \textit{Id.} at App.
\textsuperscript{161} \textit{Id.} at 2.
\textsuperscript{162} \textit{RE&D Subcommittee Recommendations, supra} note 56.
The primary goal of the 1998 Plan was to reduce the number of runway incursions to 248 (a 15% reduction from the 1997 level) by the year 2000. However, recall that the FAA's goal in 1997 was to reduce the number of runway incursions to forty-one by the year 2000. This adjustment represented a 600% retreat from the FAA's 1997 safety goals.

The 1998 Plan was designed to provide a "highly focused central management team structure and a system-wide approach to accomplishing the Plan's goals and objectives." The 1998 Plan introduced five objectives that the FAA believed would lead to a reduction in runway incursions: (1) improved planning, data collection/analysis, and program management; (2) improved pilot/controller communications and pilot/crew training; (3) provide traffic controllers with improved tools, techniques, and capabilities for managing airport surface traffic; (4) improved airport surface facilities, design, and operation; and (5) improved awareness in the aviation community of runway incursion risk.

The FAA set-up an organizational structure designed to improve the efficiency of the Runway Incursion Program. At the top of the organization was the Runway Incursion Program Office that provided "direction, guidance, and oversight" for the various projects aimed at reducing runway incursions. Furthermore, a Runway Incursion Leadership Team was formed whose membership included representatives from various FAA divisions involved in the Runway Incursion Program. Finally, the 1998 Plan included a provision for the development of a Program Implementation Plan (PIP) that would be used to prioritize and evaluate the progress of the various initiatives the FAA would pursue.

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164 Id. at 1.
165 See supra note 139 and accompanying text.
166 1998 SAFETY ACTION PLAN, supra note 163, at 1.
167 Id. at 2, 12-25.
168 Id. at 4.
169 Id.
170 Id.
On February 4, 1999, John O'Brien, the Director of the Engineering and Air Safety Department of the ALPA testified before the House of Representatives Subcommittee on Aviation on the FAA’s failure to enhance runway safety. O’Brien expressed concern that the FAA was not meeting certain congressional directives to improve aviation safety. In particular, Mr. O’Brien indicated that the FAA failed to follow the direction of 49 U.S.C. § 47101(f), which lists numerous aviation safety items that are to be “maximally implemented.” Four of the specified safety items enumerated in this statute pertain to runway safety. Two of the safety items, an airport surface movement radar system and a taxiway lighting and sign system, had been required by statute since 1987.

On July 21, 1999, the DOT/IG issued another Audit Report (1999 Audit) reviewing the FAA’s Runway Incursion Program. The opening sentence of the 1999 Audit’s “Results-In Brief” section sets the tone: “[The] FAA’s Runway Safety Program continues to be ineffective in reducing runway incursions.” The report also emphasized that “[p]rogress to reduce runway incursions has not been made.” The DOT/IG noted that the number of runway incursions continued to rise during 1998 to the highest level since the FAA began tracking runway incursion data. In addition, Pilot Deviations reached record levels and accounted for 56% of all runway incursions. The 1999 Audit went on to discuss the severity of runway incursions that had occurred in the first six months of 1999 by citing two runway incursions (one

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172 Id.

173 Id. See also 49 U.S.C. § 47101(f) (2000).

174 Id. § 47101(f)(7),(8),(9),(10).


177 Id. at ii.

178 Id. at 4 (emphasis in original).

179 Id. at ii. In 1998, runway incursions reached record levels with 325 occurrences. See Table I, supra Part II(C).

180 1999 AUDIT, supra note 176, at ii. See also Table I, supra Part II(C).
at O'Hare airport in Chicago and one at JFK airport in New York) in which large passenger jets on take-off narrowly missed other passenger jets that had entered the runway.\footnote{1999 Audit, \textit{supra} note 176, at iii. For a discussion of these runway incursion incidents, \textit{see supra} Part II.(C).}

The 1999 Audit indicated that \textit{none} of the initiatives from the 1998 Plan directed at pilot training, education, and awareness had been implemented, while nearly 50\% of the technology-based initiatives had been implemented.\footnote{1999 Audit, \textit{supra} note 176, at v.} This occurred despite the fact that DOT data indicate that the majority of all runway incursions are caused by Pilot Deviations.\footnote{\textit{See supra} Part II.(D).} Therefore, increased pilot training, education, and awareness should be the obvious targets for immediate improvement in runway incursion reduction.

In fact, the DOT/IG specifically noted that 65\% of the short-term goals discussed in the 1998 Plan had not been implemented.\footnote{1999 Audit, \textit{supra} note 176, at iv.} The 1999 Audit also noted that the AMASS system was continuing to experience schedule delays and cost overruns.\footnote{\textit{Id.} at vi-vii.} The 1999 Audit presented six recommendations for improvement to the Runway Incursion Program, including: (1) the need for the FAA to establish a central management structure to ensure that the 1998 Plan initiatives are executed; (2) the need for the FAA to revise the AMASS development schedule and request additional program funding; and (3) the need for the FAA to determine funding requirements for the implementation of 1998 Plan initiatives in 2001 and beyond.\footnote{Id. at viii-ix.} The FAA concurred with the recommendations and agreed to take corrective action.\footnote{Id. at ix.} However, the DOT/IG was not satisfied with the FAA's response to the recommendation for determination of program funding requirements for 2001 and beyond. The DOT/IG specifically noted that the FAA's response was "unclear" as to how the FAA would determine its funding requirements for the overall operating budget of the 1998 Plan.\footnote{Id. at x.}
VI. RUNWAY SAFETY IN THE NEW MILLENIUM

A. The FAA's Runway Incursion Program is Reborn

In October 1999, the FAA announced a “make-over” of the Runway Incursion Program in the form of a new Runway Safety Program (RSP). The mission of RSP is to reduce the number of runway incursions and incidents. The RSP defined three broad goals in its effort to improve runway safety: (1) decrease the number of ATC Operational Errors and Deviations; (2) increase individual airport efforts on reducing the number of Vehicle and Pedestrian Deviations; and (3) increasing the standards for investigating and analyzing Pilot Deviations.

In furtherance of its renewed efforts to increase runway safety, the FAA appears to be focusing more directly on the primary cause of runway incursions – Pilot Deviations. Since the beginning of 2000, the FAA has conducted over 600 safety seminars for pilots to educate them on safe airport ground operations. In addition, the FAA has announced new runway safety initiatives, established a Runway Incursion Information and Evaluation Program for better data gathering, and conducted a major “runway safety summit” in June 2000 at the urging of U.S. House of Representatives member Frank Wolf. More than 500 aviation safety experts attended the three-day event.

However, in a decision that contradicts the efforts to reduce runway incursions, the FAA failed to renew a contract with the National Association of State Aviation Officials (NASAO) for runway safety inspections at smaller airports. This program had been in place for ten years and provided for safety surveys of nearly 5,000 runways every three years. The runway information provided by the NASAO had been used to provide detailed runway charts to pilots. Interestingly, the NASAO only

\[\text{References:}\]

189 SAFETY RECOMMENDATION, supra note 30, at 9.
190 See NTSB Press Release, supra note 34.
191 SAFETY RECOMMENDATION, supra note 30, at 9.
192 Id.
193 Id. See also Cable News Network, supra note 34.
195 The failure to renew the runway inspection program was due to the FAA’s desire to reduce its operating budget. NASAO Officials Upset Over Lapse of Airport Inspection Program, WEEKLY OF BUS. AVIATION, Oct. 9, 2000, at 160.
196 Id.
197 Id.
charged the FAA $325 per inspection, for a total cost of approximately $1.625 million for the inspection of 5,000 runways every three years – equivalent to a yearly program cost of only $542,000.198 Under the FAA’s new runway inspection program, state aviation authorities will have to apply for reimbursement from the FAA for the cost of inspections the state agencies conduct.199 According to Steve Ogrodzinski, president of the NASAO, the FAA’s new runway inspection plan will create “considerable” paperwork for state aviation authorities and result in the elimination of an “efficient [safety] program.”200

B. Near-Term Safety Initiatives

As a result of the information gathered during the safety summit in June 2000, the FAA reviewed several-hundred safety recommendations.201 The FAA selected ten near-term initiatives that it determined were most likely to reduce runway incursions.202 The ten initiatives were selected using the following criteria: (1) each initiative could be implemented within thirty days; (2) each initiative could be completed by the end of the year 2000; and (3) each initiative had a high potential for reducing runway incursions.203 On August 1, 2000, the FAA released a report entitled “Ten Initiatives for Reducing Runway Incursions,” in which the following near-term initiatives were discussed:204

1. Initiative #1: Enhance Operational Tower Controller Training

Training will be provided to aid controllers in maintaining situational awareness and prioritizing aircraft movements so as to maintain adequate separation between aircraft.205

2. Initiative #2: Foreign Air Carrier Pilot Training, Education, and Awareness

Training will be designed to educate pilots of foreign airlines on the prevention of runway incursions at U.S. airports.206

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198 Id.
199 Id.
200 NASAO Officials, supra note 195.
201 Near Term Initiatives, supra note 100, at 3.
202 Id.
203 Id.
204 Id.
205 Id. at 5-6.
206 Near Term Initiatives, supra note 100, at 7.
3. Initiative #3: Advisory Circular for Airport Surface Operations

An advisory bulletin will be published that itemizes the “best practices” for airport ground operations that will include guidelines for the implementation of standard pilot procedures for safe airport ground operations.\textsuperscript{207}

4. Initiative #4: Improved Runway Markings

Runway markings, particularly the yellow “hold line,” which shows a pilot where to stop when approaching a runway intersection, will be increased in size (from 6-inch width to 12-inch width) and outlined in black paint to improve visibility.\textsuperscript{208}

5. Initiative #5: Education and Training for Pilots, Controllers, and Vehicle Operators

Educational and training materials will be provided to aircraft pilots, ATC personnel, and airport ground vehicle operators to aid in their awareness and avoidance of runway incursion risks. The effectiveness of this effort will be tracked and training materials will be updated as required.\textsuperscript{209}

6. Initiative #6: Memory Enhancement Techniques Training for Tower Controllers

Training will be provided to tower controllers to teach memory aids to assist controllers in remembering locations of aircraft and vehicles in the airport operations area. Training will be focused on enhancing memory techniques under unusual and adverse operating conditions such as abnormally high aircraft operations volume or adverse weather.\textsuperscript{210}

7. Initiative #7: Pilot/Controller Communications Phraseology Review

Communications procedures between pilots and controllers will be revised to reduce confusion and ease workloads. This initiative will likely include the requirement that pilots repeat all controller requests to “hold-short” of an active runway or taxiway.\textsuperscript{211}

\textsuperscript{207} Id. at 8-9.
\textsuperscript{208} Id. at 10-11.
\textsuperscript{209} Id. at 12-15.
\textsuperscript{210} Id. at 16-17.
\textsuperscript{211} NEAR TERM INITIATIVES, supra note 100, at 18-19.
8. Initiative #8: Improved Pilot Evaluation and Testing

All pilot check flights will evaluate the pilot's ability to safely operate on the airport surface. The testing will include knowledge of airport signs, markings, lighting, and communications.212


Controller teamwork training will be conducted at ten airports with the highest number of runway incursions caused by Operational Errors.213

10. Initiative #10: Technology Assessment

A technical evaluation team will be formed to determine which technologies have the greatest potential to reduce runway incursions. The team will evaluate and select which technologies will be implemented at airport facilities.214

C. Long-Term Safety Initiatives

In October 2000, the FAA issued the “National Blueprint for Runway Safety” (Blueprint).215 This document is intended to provide guidelines by which the FAA, and the aviation community as a whole, will work to reduce runway incursions and achieve a safer runway environment.216 The Blueprint contains a discussion of the history of the runway incursion problem and a brief discussion of the FAA's past safety initiatives.217

The organization and management of the FAA's runway incursion effort has changed drastically since the FAA began serious monitoring of the problem starting in 1988. The Blueprint discusses the current management structure of the RSP.218 In essence, the RSP program office is the focal point for all runway incursion activity. The RSP program office coordinates the efforts of the FAA, the aviation community (including commercial airlines and pilot groups), manufacturers of the technology

212 Id. at 20-21.
213 Id. at 22.
214 Id. at 23.
216 Id. at v.
217 Id. at 3-21.
218 See id. at Part IV.
used to enhance runway safety, the media, academia, and other national and international governmental organizations.\textsuperscript{219} Regional RSP managers direct regional activities to reduce runway incursions and report their activity to the national RSP manager.\textsuperscript{220}

However, the core of the Blueprint is found in the discussion of the safety initiatives that the RSP has defined to improve runway safety. The RSP has organized the initiatives into seven categories.

1. \textit{Training Initiatives}

The safety initiatives in the Training category are designed to improve the performance, knowledge, and skill of pilots, air traffic controllers, and all other personnel who operate in the airport environment.\textsuperscript{221} The Blueprint specifically lists seventeen training initiatives that the RSP believes are imperative to enhancing runway safety. Among these initiatives are plans to develop testing standards for pilots to determine if more training is required to prepare the pilots for operation on the airport surface, development of training courses for air traffic controllers to aid them in maintaining situational awareness of the airport environment, distribution of pilot training materials focused on runway incursion prevention, and development of Runway Construction Safety Plans which would train airport construction crews in the safe operation of equipment in the airport surface environment.\textsuperscript{222}

In addition to the training initiatives, the Blueprint specifically states that the RSP intends to develop a "culture" that emphasizes runway safety and cooperation among airline operators, such as sharing of data and review of air carrier procedures that may hinder safety.\textsuperscript{223} This element is important because it indicates that the FAA intends to hold accountable the various parties involved in airport surface operations, and it shows that runway safety can only be improved by a combined effort of the entire aviation community.

\textsuperscript{219} \textit{Id.} at 23.
\textsuperscript{220} 2000 \textit{BLUEPRINT, supra} note 215, at 22.
\textsuperscript{221} \textit{Id.} at 12.
\textsuperscript{222} \textit{Id.} at 12-15. Construction equipment on the airport surface can pose a serious risk of a runway incursion. See \textit{supra} note 28 and accompanying text.
\textsuperscript{223} 2000 \textit{BLUEPRINT, supra} note 215, at 15.
2. Technology Initiatives

The Technology Initiatives are intended to supplement the training initiatives discussed above, as well as fill the safety void created by the ever-present factor of human error. The RSP intends to form a technical evaluation team to assess developing technologies to enhance runway safety. In addition, the RSP will continue to implement existing runway safety technology such as ASDE-3 and AMASS, as well as develop new technologies that can be implemented at airports of all sizes around the United States. However, the Blueprint contains no discussion of how it plans to completely implement the over-budget and behind-schedule AMASS system in the near future.

3. Communications Initiatives

The Communications Initiatives are intended to improve radio communications between air traffic controllers, pilots, and vehicle operators on the airport surface. The RSP plans to provide guidelines on the level of English language proficiency that foreign pilots must have in order to safely operate in the airport environment and to standardize pilot/controller phraseology in an effort to reduce confusion in communications.

4. Procedures Initiatives

The Procedures Initiatives are intended to determine the impact on the aviation community of a change in airport operating procedures to enhance airport ground safety. Included in this group of initiatives are efforts to fund construction of perimeter roads for airport ground vehicles to segregate them from aircraft operations. In addition, the RSP will determine if the CFRs should be amended to require pilots to obtain controller clearances prior to crossing any runway, not just the active runway. Importantly, the Blueprint indicates that where a specific controller clearance has not been obtained to cross a
runway, the pilot should stop short of crossing the runway and wait for clearance to cross. 252

5. Airport Signs, Markings, and Lighting Initiatives

These initiatives are intended to improve the safety of the airport surface environment by improving the visibility and readability of airport signs and lighting that guide pilots to various locations on the airport surface in an effort to prevent pilots from becoming lost. 253 The Blueprint calls for inspection teams to evaluate the quality of airport surface signage and lighting as well as encourages the use of funds to improve signs and lights where needed. 254 Interestingly, this was the precise task of the NASAO, whose contract for runway safety inspections was not renewed by the FAA due to budget concerns. 255

6. Data, Analysis, and Metrics Initiatives

As discussed previously, the true scope of the runway incursion problem cannot be accurately measured because the quality and accuracy of runway incursion data is suspect. This set of initiatives is intended to improve runway incursion data collection and analysis to aid the RSP in evaluating the effectiveness of other runway safety initiatives, as well as to provide insight into the precise causes of runway incursions. 256 For example, the RSP intends to establish and maintain universal databases of runway incursion data and develop software tools that make data analysis easier and more useful. 257

7. Local Solutions Initiatives

This set of initiatives is intended to provide support to local aviation authorities to improve runway safety at the local level and share "lessons learned" between air traffic facilities across the nation. 258

It is interesting to note that the seven major initiatives presented in the Blueprint closely follow the ten near-term initiatives presented by the FAA in August 2000. Many of these

252 2000 Blueprint, supra note 215, at 17.
253 Id. at 18.
254 Id. at 19.
255 See supra notes 194-199 and accompanying text.
256 2000 supra notes 194-199 and accompanying text.
257 Id.
258 Id. at 20.
same initiatives were also included in the failed Runway Incursion Plans developed in the 1990s. It now appears as if the FAA and the RSP are narrowly focusing their efforts on the factors they believe to be at the heart of the runway incursion problem. Furthermore, the Blueprint recognizes that human factors are an integral part of the seven major safety initiatives since human beings (pilots, controllers, and ground personnel) must be involved in all aspects of those initiatives.\(^{239}\)

Despite its narrower focus, the Blueprint still contains serious flaws that may affect efforts to improve runway safety. For example, the 2000 Blueprint apparently has a life of only one year. The 2000 Blueprint specifically calls for the creation of another Blueprint due for release in October 2001.\(^{240}\) In order for a runway safety program to be effective, it should look to the long-term and not focus on a single year of activity. While it is obvious that runway safety initiatives may need to be modified as they are implemented over time, the current Blueprint provides no goals for the long-term reduction of runway incursions. Specifically, the Blueprint contains a list of milestone dates and activities, none of which extend past October 2001.\(^{241}\) Runway incursions have been occurring since at least 1929 and the world has witnessed numerous ground collision disasters in the last quarter century. A long-term outlook with long-term goals should be established so that the aviation community has a measurable goal to work toward and measure its progress against. Prior Runway Incursion Plans have looked to a long-term time frame to establish goals for runway incursion reduction. Unfortunately, as discussed above, all of those initiatives have fallen short for various reasons. It is plausible that the FAA has purposely left out any measurable goals — such as a long-term target for the TRIR — for improving runway safety since they have an established record of setting runway safety goals and failing to meet them.

In addition, the current Blueprint is devoid of any detailed discussion of how the enumerated safety initiatives will be implemented. In effect, the Blueprint is merely an outline with only a general discussion of the planned initiatives. There is little discussion of budgetary limitations or allotments to the various initiatives or time frames when the activities of the initiatives will be

\(^{239}\) *Id.*

\(^{240}\) *Id.* at 29.

\(^{241}\) See *id.* at 24-29.
expected to produce results or what those results may be. In essence, the current Blueprint is similar to the prior failed Runway Incursion Plans.

The runway incursion safety initiative appears to be reborn once again. However, continual rebirth is clearly not what is required to solve the potential disaster that runway incursions pose to the flying public. Long-term vision is required to see the program through fruition and develop a safer aviation infrastructure. Outlines of a course of action are very necessary to guide the runway incursion program. However, without a detailed set of executable plans, it is possible that the current Blueprint will fall flat, as have its predecessor plans. Identifiable and measurable goals are an absolute necessity so that the RSP can access how far it must go to reach its goals and what must be done to keep the RSP on track. The FAA has been creating runway incursion plans for over a decade, yet there has been nearly nonexistent beneficial execution of those plans.

D. An Assessment of Runway Incursion Data from 2000

As this article when to publication, the last full year of available FAA data concerning runway incursions was 2000. At the end of 2000, official FAA data indicated that the total number of runway incursions rose to 431.\textsuperscript{242} Table II shows the comparison of runway incursion data between 1999 and 2000.\textsuperscript{243}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
Year & Number of Incursions \\
\hline
1999 & 319 \\
2000 & 431 \\
\hline
\end{tabular}
\caption{Comparison of Runway Incursion Data between 1999 and 2000}
\end{table}

\textsuperscript{243} Id.
## TABLE II: FAA RUNWAY INCURSION DATA – 2000 VS. 1999

<table>
<thead>
<tr>
<th>Runway Incursions</th>
<th>Pilot Deviations</th>
<th>Operational Error/ Deviation</th>
<th>Vehicle/ Pedestrian Deviations</th>
<th>Miscellaneous Deviations</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
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<td>20</td>
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<td>6</td>
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<tr>
<td>Yearly Totals</td>
<td>259</td>
<td>182</td>
<td>87</td>
<td>78</td>
<td>85</td>
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</table>

The 2000 data represents a 34% increase in runway incursion events over the 321 runway incursions reported in 1999. Total aircraft operations for 2000 totaled 67,480,097, for a TRIR of 0.64. This represents a 36% increase in the TRIR from 1999 to 2000. Recall that in 1998, the FAA set a goal to reduce runway incursions to 248 by the year 2000. Therefore, the preliminary year 2000 data shows a 74% increase over the FAA’s revised reduction goal (and a ten-fold increase over the original year 2000 reduction goal of 41 incursions as targeted by the 1995 Plan). Runway incursions caused by Operational Errors/ Deviations increased nearly 12% to 87 incursions from the 78 incursions reported in 1999. Runway incursions caused by Pilot Deviations rose nearly 42% to 259 incursions from the 182 incursions reported in 1999. Runway incursions caused by

*244* The FAA has included the “Miscellaneous” category to cover incursion situations that are not attributable to the other three deviation categories. For example, a runway incursion caused by equipment failure would be included in the “Miscellaneous” category. See FAA, 2000 Blueprint, supra note 215, at 2.

*245* Data from Table I, supra Part II.C.

*246* See supra note 163 and accompanying text.

*247* Data derived from Table II.

*248* Id.
Vehicle and Pedestrian Deviations increased by nearly 39% to 85 incursions from the 61 incursions reported in 1999. The distribution of causes leading to runway incursions remained relatively constant from 1999 to 2000 with Pilot Deviations causing approximately 60% of all runway incursions.

An in-depth analysis of the effect of the FAA's year 2000 runway safety activities on runway incursion occurrences is difficult for a variety of reasons. First, the monthly fluctuations in the number of runway incursions are apparent in the data from both 1999 and 2000. As such, it is difficult to determine if the monthly changes in the number of runway incursions in 2000 are a result of the various safety activities conducted by the FAA in 2000, or if those changes are simply a function of the fluctuation in total airport operations throughout the various travel seasons of the year.

Furthermore, it is possible that the drastic increase in reported runway incursions from 1999 to 2000 is not the result of the increasing number of actual incursions, but rather, a result of the increasing awareness of incursions. As the FAA issues more information on runway incursions, as done through the various programs it conducted in 2000, pilots and air traffic controllers are becoming increasingly aware of the problem and its causes. While it is impractical to assume that the number of actual runway incursions has remained constant from 1999 to 2000, it is possible that the major factor in the increase in reported runway incursions is an increased awareness of when a runway incursion has occurred. As pilots and air traffic controllers become more aware of the FAA's efforts to reduce incursions, they may be assessing airport traffic situations more critically and realizing that an incident meets the FAA's definition of a runway incursion and reporting the incident as such. In this respect, the FAA's safety initiative to increase the reliability of runway incursion data may be laying the foundation for a better assessment of the runway incursion problem. However, it is critical to note that no matter how the data is being reported – actual increases of runway incursions or an increased awareness of a fairly constant number of incursions – it is clear, as mentioned above, that the true scope of the runway incursion problem is underestimated by the data.

249 Id.

250 The author notes that this could also be a factor in the increase in runway incursions from 1988 to 1999. See Table I, supra Part II(C).
However, as a point of reference, if we assume that all runway incursions are reported accurately and that the runway incursion numbers for 2000 represent only an increase in actual runway incursions, the scope of the increase in runway incursion danger comes into focus. Assuming that the 431 runway incursions reported in 2000 represent the true number of actual incursions, the data analysis described previously indicates that by the year 2010 (if current trends are not reversed), the United States may experience as many as 1,983 runway incursions per year (nearly 5.5 incursions per day) for a Total Runway Incursion Rate of 2.37.251

E. 2001 Brings Marginal Progress in Runway Safety

The tragic events of September 11, 2001, had a dramatic effect on air travel in the United States. From September 11th through the end of the year, air traffic was drastically reduced as airlines cancelled flights and the public avoided air travel. As such, airport operations for the last four months of 2001 are expected to be much lower than for the same period in the previous years. Therefore, an analysis of runway incursion data for all of 2001 would not yield much useful comparative information since one-third of that data would be skewed by the severe reduction in air traffic caused by the terrorist attacks. However, useful comparisons may be made between the first eight months of 2001 and the same time period in 2000.

Preliminary runway incursion data for the first eight months of 2001 indicate a slight improvement in runway safety compared with the first eight months of 2000. Table III shows the comparison of runway incursion data between January and August of 2000 and 2001.252

251 See supra notes 41 and 43 and accompanying text.
252 FAA, Runway Incursion Totals – CY01 vs. CY00, at http://www.faarsp.com/daily/xritot01-00.htm (last modified Apr. 1, 2002).
TABLE III: 
FAA RUNWAY INCURSION DATA — 2001 VS. 2000 
(JANUARY — AUGUST)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Pilot Deviations</th>
<th>Operational Error/ Deviation</th>
<th>Vehicle/ Pedestrian Deviations</th>
<th>Miscellaneous Deviations</th>
<th>Totals</th>
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<td>157</td>
<td>179</td>
<td>66</td>
<td>59</td>
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</table>

The eight-month data for 2001 indicates that the runway incursion problem at U.S. airports has improved slightly in the last year. The total number of runway incursions for the first eight-month of 2001 has decreased slightly (down 4.8%) compared to the same time period in 2000. In particular, runway incursions attributed to Pilot Deviations decreased approximately 12%, while Operational Errors and Deviations increased approximately 12%. Vehicle and Pedestrian Deviations remained relatively constant. Through the first eight months of 2001, U.S. airports experienced 278 runway incursions. Had tragic events not intervened on September 11th, U.S. airports were on track to experience 415 runway incursions – a mere 5% reduction from the 431 runway incursions of 2000.

The data in Table III indicates that the FAA’s ten “Near Term Safety Initiatives” might be starting to produce the improvement in runway safety that the FAA anticipated. However, none of the ten near term safety initiatives met the criteria set by the FAA.

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253 The FAA has included the “Miscellaneous” category to cover incursion situations that are not attributable to the other three deviation categories. For example, a runway incursion caused by equipment failure would be included in the “Miscellaneous” category. See FAA, 2000 Blueprint, supra note 215, at 2.
254 Data derived from Table III.
255 Id.
256 Id.
when those initiatives were selected.\textsuperscript{257} As discussed previously in Part VI. (B), the near term safety initiatives were partially selected on the basis that they could be implemented by September 1, 2000, and completed by the end of 2000.\textsuperscript{258} However, as of June 2001, 90\% of the near term initiatives remained incomplete.\textsuperscript{259} In fact, two of those initiatives will not be completed until the first quarter of 2002.\textsuperscript{260} The incomplete implementation of these safety programs provides one possible explanation for the lack of significant improvement in safety on the nation's runways.

On a slightly positive note, in June 2001, the FAA released the results of a statistical study of runway incursions at U.S. airports between 1997 and 2000.\textsuperscript{261} This report classifies runway incursions by orders of severity. The FAA noted that only 19\% of all events that meet the definition of a runway incursion result in a significant potential for an actual collision, while 46\% of all runway incursions create little or no chance for collision.\textsuperscript{262}

\section*{VII. CONCLUSION}

At the runway safety summit in June 2000, Jane Garvey, the FAA Administrator, stated that "Improving runway safety has my full attention . . . Improving runway safety is one of the most critical aviation safety issues the aviation community faces. We know how to meet challenges . . . Now, let's begin."\textsuperscript{263}

Administrator Garvey's words are curious in light of the fact that the FAA actually began initial runway incursion safety activities prior to 1986. Since 1991, when the FAA developed its first formalized runway safety improvement plan, no ascertainable improvement in runway safety has occurred, despite the fact that Congress had appropriated over $330 million to runway incursion programs through Fiscal Year 1998. In fact, each of the FAA's successive runway safety plans has failed to achieve its stated goals.

Perhaps the biggest failure in the runway safety program is the continuing inadequacy of accurate runway incursion data. Nearly fifteen years ago, the NTSB criticized the FAA for its lack

\textsuperscript{257} See Technology Testimony, supra note 47, at Attachment E.
\textsuperscript{258} See supra Part VI. (B).
\textsuperscript{259} See supra note 47, at Attachment E.
\textsuperscript{260} See id.
\textsuperscript{261} RUNWAY INCURSION SEVERITY REPORT, supra note 18.
\textsuperscript{262} Id. at 9-10.
\textsuperscript{263} Garvey Remarks, supra note 1.
of measurable data. Since that time, every runway incursion plan has included an initiative focusing on improving data collection and analysis, yet every review of the FAA’s efforts has pointed out that little improvement has occurred. Without accurate data, the starting point for any type of analysis, a true understanding of the runway incursion problem will elude those attempting to improve runway safety. The FAA should redouble its efforts to improve data collection and analysis, starting with control tower airports. Once accurate data is obtained for these most critical locations (accounting for only 4% of all U.S. airports), the FAA must look to quantifying the problem at the remaining uncontrolled airports. Only then can an accurate picture of the nationwide runway incursion problem be obtained, and efforts directed at achieving a safer aviation infrastructure.

While the “severity statistics” presented in the FAA’s June 2001 report may alleviate some fear among the flying public, those data must be viewed with extreme caution, as the numbers tend to downplay the danger on the nation’s runways. Admittedly, the majority of all runway incursions do not result in a significant risk of collision. However, the lower risk of a collision is merely a matter of circumstance rather than an airport operating system performing at its safest. Runway incursions of any severity are caused by human and mechanical error and those errors must be reduced. The same mistakes that cause a runway incursion of the slightest severity can also result in a collision as catastrophic as the Tenerife disaster. It is those errors that must be corrected through FAA initiatives.

As discussed above, many other problems have plagued the FAA’s efforts to improve runway safety – failing to achieve incursion reduction goals, focusing on the wrong areas for improvement, failing to comply with statutory regulations regarding runway safety, and failure of technological solutions to come to fruition. All of these shortcomings must be eliminated to make the FAA’s runway incursion initiatives a reality. It remains to be seen whether the 2000 Blueprint will be a more successful safety plan than its predecessors. As the Blueprint’s safety initiatives are merely restatements of the initiatives presented in the previous runway safety plans, it appears as though only improved execution of those initiatives will make airport ground operations safer. The lives of the flying public are in the hands of the FAA administration and their ability to effectively implement the
2000 Blueprint (and its successors) is vital to improving aviation safety.

In an interview with CBS News, Bob Bragg, the co-pilot of the PanAm 747 involved in the Tenerife disaster, accurately summed up prior efforts at reducing runway incursions: "It seems like we have to have a major accident before things like this [runway incursions] get taken care of. My point is, it's twenty-three years after we were talking about doing something and we still have not done anything about it." Now is not the time for the FAA to "begin" its efforts—it is time for the FAA to quickly and effectively act to improve a struggling aviation safety program of national importance. It is now time to for the FAA to prove to the flying public that the FAA knows how to meet challenges and is focusing its attention on reducing runway incursions at U.S. airports.

In light of the great tragedies of September 11, 2001, it is important to remember that the worldwide aviation system faces many other safety challenges beyond those caused by terrorist acts. While the immediate focus of aviation safety is on preventing acts of terrorism on-board commercial airlines, many other safety risks, present before the New York, Washington D.C., and Pennsylvania terrorist attacks, continue to expose the flying public to danger. The FAA and other aviation safety authorities must continue to focus on all issues affecting aviation safety. While it is likely that progress in other aviation safety programs will be temporarily sacrificed for the benefit of reducing aviation terrorism, we must all remember that many other safety risks must be addressed before the aviation system reaches more acceptable levels of safety. Congress must continue to provide funding and personnel to the myriad of programs created to reduce the safety risks inherent in the aviation system. Aviation authorities around the world should bear in mind the potential long-term negative effects of focusing solely on safety issues resulting from recent world events to the detriment of other pressing safety concerns.

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