Aviation safety Management: Runway incursion, excursion and confusion

Dung R. Pam
Executive Summary

It is incontrovertible that every commercial aeroplane flight begins and ends with a runway. Thus runway safety has always been an important factor to manufacturers, regulators, airline operators and air traffic service providers. However, runway excursion, incursion and confusion are becoming a major source of concern to global aviation safety. To drive home the point, every 1 hour about 20.8Million people are waiting to land on a runway.

This paper will attempt to explicitly describe these three categories of runway events and the current industry initiatives to prevent accidents caused by them. Consideration will be given to the multilateral approach involving major stakeholders to improve runway safety.

Background

In 2005, data from Eurocontrol showed the EU experienced more than 600 runway incursions. This showed an average of two incursions every day and one serious incursion every 14 days.

Though the rate of runway incursions in the USA has remained relatively constant, serious incidents have actually increased by 10% from the levels obtained in 2004. This rise can be attributed in part to increased traffic congestion in the terminal areas, approach and landing as well as aircraft, vehicular and human movements on taxiways.

According to Boeing, the current in-service commercial aircrafts numbering 19,500 will be joined by an additional 16,900 aircrafts; boosting total in-service commercial aircrafts to a staggering 35,800 aeroplanes by 2027.

As if to exacerbate the situation, airport council international (ACI) which had earlier projected a 17% gap between airport capacity and traffic demand by 2025, has now revised the gap to 25% by 2030. So if congestion is the true catalyst to this enigma, it is going to get worse unless mitigated.

On the general aviation front, Eurocontrol is expecting 100 private jets to join the European skies every year, bringing the in-service total to 700 by 2015.
What are excursions, incursions and confusion?

Runway excursion is any occurrence when an aircraft departs the runway in use during the take-off or landing run. Expounding further, this occurs when a:

- Departing aircraft fails to become airborne before reaching the end of the runway or is unable to stop during a rejected take off before reaching the end of the runway.
- Landing aircraft is unable to stop before the end of the runway or departs the side of the runway.

Excursions account for 96% of runway accidents and results in 80% fatalities in this category. A classic example is the 2nd August Airfrance 385 overrun in Pearson international airport, Toronto. A more recent example was the Dec. 20, 2008 Continental 1404 B737 excursion at Denver International Airport in which at least 38 people were injured.

Runway incursion is any occurrence at an aerodrome involving the incorrect presence of an aircraft/vehicle/person on the protected area of a surface designated for the landing and take off of aircraft. There are four categories of runway incursions:

- A is a serious incident in which a collision was narrowly avoided.
- B is an incident in which separation decreases and there is a significant potential for collision, which may result in a time critical corrective/evasive response to avoid a collision.
- C is an incident characterized by ample time and/or distance to avoid a collision.
- D is an incident that meets the definition of runway incursion such as incorrect presence of a single vehicle/person/aircraft on the protected area of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences.

A catastrophic case was the 27th March, 1977 Tenerife runway collision; involving two Boeing 747’s resulting in 583 fatalities.
Runway confusion occurs when an aircraft takes off from or lands on the wrong runway. Examples are the 31st October 2000 accident of Singapore 006 (83 fatalities) at Chiang Kai-shek airport in Singapore and more recently, the 27th August 2006 Comair CRJ100 accident at Blue Grass airport in Lexington, Kentucky resulting in 49 fatalities.

How bad is it?

The data below was culled from a study conducted by the Runway safety initiative and presented by Earl Weener (PhD.) in October 2008.

<table>
<thead>
<tr>
<th>Occurrence</th>
<th>1995-2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No: of occurrence</td>
</tr>
<tr>
<td>Total accidents</td>
<td>1332</td>
</tr>
<tr>
<td>Fatal accidents</td>
<td>464</td>
</tr>
<tr>
<td>Excursion</td>
<td>363</td>
</tr>
<tr>
<td>Incursion</td>
<td>10</td>
</tr>
<tr>
<td>Confusion</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 1: Runway events 1995-2007.

What is the aviation community doing to address Runway safety?

The runway safety initiative (RSI) spearheaded by flight safety is an example of the multi-lateral approach to address the challenge of runway safety. This is an international effort with participants representing all major stakeholders in global aviation; comprising regulators, manufacturers, operators, service providers and airport authorities. A synopsis of some their remedial strategies:
Regulators

The overarching responsibility for aviation safety lies with the regulator. Therefore, most of the regulator strategies will be directed at providing adequate oversight and monitoring the implementation of agreed strategies and mandates by the service providers/operators.

There is the need for global harmonisation of all practices and procedures associated with runway operations. This should include:
- Standards for airplane certification and operational requirements for takeoff and landing operations on contaminated runways
- Landing distance assessment requirements, including minimum landing distance safety margins, to be performed at the time of arrival
- Runway surface condition reporting and minimum surface conditions for continued operations.
- Approaches with vertical guidance.
- Encourage voluntary reporting of runway events.

Manufacturers

Manufacturers are expected to step up their game in rolling out safe and reliable aircraft and ancillaries. This should be supported by the provision of valid data for both normal and non-normal operations.

A plethora of runway safety enhancements to current onboard systems are already in the market. One currently fitted on the A380 is “SAMM” or Surface Area Movement Management developed by Thales and designed to increase airport surface situational awareness to reduce incursion by displaying synoptics of active or closed runways, traffic and runway incursion alerting during taxiing.

Other integrated additions to the current onboard equipment (ECAM) include the brake-to-vacate software and “Runway awareness and advisory system”. This is an economical software add-on to Honeywell's Enhanced Ground Proximity Warning System (EGPWS) that provides pilots with audible warnings if they are taxiing onto an active runway unintentionally.
**Aircraft Operators**

The frontline operators usually get the short straw in this debacle”. About 58% of runway incursion errors are attributed to pilots, 22% to controllers, and 20% to airport vehicle drivers, according to Eurocontrol. The usual antidote; training!

However, any prescribed training should include both qualitative as well as quantitative objectives. The areas of priority should include:

- Stabilised approach criteria.
- True no-faults go-around policy.
- Decision making on approach and on the runway.
- Extra vigilance during ground operations during low visibility procedures.
- RT discipline to reduce incidents of call sign confusion.
- Mandatory readback of all critical clearances.
- Incorporate runway incursion training in flight crew and pilot training.
- Prolonged loss of communication.
- Procedures for ground operations.

Airlines are also currently evaluating Electronic Flight Bags, moving map displays and aural alerting cockpit technology in order to reducing runway incursions/excursions/confusion.

**Air traffic control (ATC) and Air navigation service provider (ANSP).**

Implementing best practice in ATC procedures including:

- The use of a common language in common areas where there is international air traffic to help enhance users’ situational awareness.
- Specific clearance required for each runway crossing.
- Cockpit resource management training for controllers.
- Most ASNP are deploying technologies to enhance controller and pilot situational awareness. Prominent among which are:
  - Airport Movement Area Safety System (AMASS).
  - Airport Surface Detection Equipment-Model X (ASDE-X).
  - The Final Approach Runway Occupancy Signal (FAROS) is an automated safety system designed to notify pilots on approach to land that the runway is occupied or otherwise unsafe for landing. The baseline FAROS utilises surveillance via ASDE-X.
Runway Status Light (RWSL) is a simple but effective viable technology for preventing runway incursions. A prototype installed at Dallas (DFW) runway in 2005, resulted in incursions decreasing by 70% over a 29 month period. There are plans to deploy this system to 22 airports by 2011.

ATC is now encouraged to provide stabilized Approach Assistance to Pilots by making available safety critical information in a timely manner including:
- Weather trends; visibility, windshear, microbursts, e.t.c.
- Runway surface Condition including marginal braking capabilities.

Airport authorities

There are resolute efforts to ensure the uniform and consistent application of ICAO provisions at all aerodromes that come under the auspices of ICAO. These include:
- Airport design.
- Construction.
- Airport lighting.
- Runway Design (crown, grooved).
- Runway markings and signage.
- Runway clearing/cleaning.
- Runway condition measurement.
- Runway Safety Areas.
- Standard Taxi Routes and Improved Access to Airport Diagrams
- Introduce a formal Driver training and assessment programme, or where already in place, review against the Driver training guidelines.
- Introduce formal communications training and assessment for Drivers and other personnel who operate on or near the runway.
- Formation of local runway safety teams.
Conclusion

The problem of runway excursion, incursion and confusion requires group synergy from the global aviation community. This is necessary if the current safety levels are to be improved, considering the impediments that increase in traffic and the 25% gap in airport capacity by 2030 will pose. The delays currently experienced in some US airports bear testimony that this is indeed a critical problem there. The NTSB has again placed the need to “Improve Runway Safety” at the top of its renowned “Most Wanted List” in the aviation category for 2009. For other countries not yet under such pressures, it’ll be sensible and prudent to learn from the American experience and implement a proactive strategy to forestall this hazard from becoming a threat worldwide. Fundamentally, runway safety can only be achieved when the aviation community is able to institutionalise Risk management “to an acceptable level where the current precursors of an unsafe environment can be checkmated.

References.

3. ICAO Annex 14, 8, Aerodrome Vehicle Operations, and attachment A
5. Earl Weener (PhD.) flight safety foundation.