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AIR PILOTS - COMMERCIAL AIR TRANSPORT
SAFETY BRIEFING NOTE 13
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RUNWAY COLLISION RISK

The Context

The largest loss of life in any aircraft accident is still the 1977 low visibility collision at Tenerife between two Boeing 747 aircraft as one began takeoff whilst the other was backtracking. Runway collision risk has since been reduced by more robust operating procedures and provision of alerting systems but the risk still has its immediate origin in human error by pilots, controllers and vehicle drivers - the latter including those towing out of service aircraft. Continued occurrence of runway collisions has led to the issue by ICAO, the Flight Safety Foundation and Eurocontrol of a Global Action Plan for the Prevention of Runway Incursions. This has useful procedural and alerting system guidance but in reality, effective risk management is airport-specific and, ultimately, direct awareness of collision risk by pilots/vehicle drivers is more effective than alerts received via controllers acting as an intermediary.

Some examples of runway collisions and near misses

- In 2016, a Boeing 737-800 taking off from Jakarta Halim as cleared was unable to avoid a wing-to-wing collision at V1 with an opposite direction and electrically dead ATR 42-600 under tow and being handled by a second controller on a discrete frequency. The aircraft under tow had been allowed to enter the runway at the same time as the 737 was beginning its takeoff after failure of the two controllers to coordinate their clearances and an underlying absence of necessary procedures.[1]
- In 2016, a departing Airbus A319 entered the single in-use runway at Cheongju (South Korea) in poor night visibility without clearance as a Boeing 737-800 was landing on it as cleared. Collision was only avoided when the crew of the 737- still at high speed - were able to initiate a lateral deviation and create a 3 metre separation between the two aircraft. The visiting Chinese A319 was still on the GND frequency as it entered the runway having not been given an explicit clearance limit.[2]
- In 2016, an Airbus A320 crew accelerating for takeoff at Shanghai Hongqiao saw an Airbus A330-300 that had just landed on the parallel runway starting to cross the runway ahead and began an early rotation which resulted in a 19 metre clearance as the A330 was overflown. The controller had forgotten previously issuing the crossing clearance when issuing the takeoff clearance.[3]
- In 2020, an Embraer 190 departing Toronto called a rejected takeoff at high speed after a bird strike just as the controller was issuing a same-runway takeoff clearance to a Boeing 777 and it was not heard. As the 777 neared rotation, its crew saw the Embraer ahead, rejected takeoff and stopped well before reaching it. The Runway Incursion Monitoring and Collision Alerting System (RIMCAS) didn't activate as its data feed wrongly showed both aircraft as airborne even though they were not.[4]
- In 2022, an Airbus A320 departing Lima in day VMC was unable to avoid a high speed collision with an airport fire appliance when it suddenly entered the runway at speed without clearance. The vehicle was destroyed and two of its occupants killed. A resultant fuel-fed fire severely damaged the aircraft although a prompt evacuation was completed without fatalities. The vehicle had entered the runway without clearance after inadequate liaison between the ATC and the Fire Service.[5]
- In 2023, an Embraer 190 about to land at Boston at night in VMC was passing 30 feet agl when its crew saw a Learjet which was taking off without clearance crossing in front of them on an intersecting runway just before their intended touchdown point. The controller's go-around instruction was

[1] see:https://knkt.go.id/Repo/Files/Laporan/Penerbangan/2016/PK-LBS%20&%20PK-TNJ%20Final%20Report.pdf
[2] see:https://skybrary.aero/accidents-and-incidents/a319-b738-cheongju-south-korea-2016 [the Official Investigation Report was only published in Korean - the detailed summary referenced is based on an unofficial translation]
[3] see: https://skybrary.aero/accidents-and-incidents/a320-a333-shanghai-hongqiao-china-2016 [Based on released information]
[4] see: http://www.tsb.gc.ca/eng/rapports-reports/aviation/2020/A20O0029/a20o0029.pdf
[5] see:https://cdn.www.gob.pe/uploads/document/file/5209692/INFORME%20FINAL%20ACCIDENTE%20DE%20AVIACI%C3%93N%20N%C2%B0%20008-2022.pdf [only published in Spanish]

prompted by an Airport Surface Detection Equipment model X (ASDE-X) alert but this was only transmitted after the Learjet had passed the intersection.[6]

Discussion

Four of the above examples arose directly from 'human factors' involving pilots, controllers or vehicle drivers. The fourth case exposed incorrect air/ground status being fed to the RIMCAS - a reminder that despite considerable experience of it, this system is not immune to functional failure. And any system which directly alerts only controllers can never be a substitute for direct alerts to pilots/drivers - the sixth example above is a stark reminder of this. A small number of the busiest US airports do have 'Runway Status Lights' (RWSL) and Final Approach Runway Occupancy Signal (FAROS) systems installed. These provide a direct runway collision warning to pilots/drivers but the cost involved means they are only a realistic option for really busy airports and even there they have not proved effective in every conflict scenario - even a direct pilot or driver alert still requires a human response.

Widespread recognition of runway collision risk has resulted in improved procedures and both pilot and controller compliance with them. Automated alerting systems warning controllers about potential conflicts have become much more common but even these 'indirect' alerting systems are only provided at relatively busy airports with their risk management value understandably proportional to the intensity and complexity of simultaneous intersecting and/or parallel runway use. Significant collision risk factors which continue to feature in investigations include the continued use of languages which are not understood by visiting pilots for communication with locally-based aircraft and when vehicles cleared to enter an active runway are not required to obtain clearance on the TWR frequency and remain on it until reporting vacated. Finally, the opportunity to recognise systemic runway collision risk is often hampered by the tendency for the depth of any incident investigation to be proportional to the severity of the outcome, when valuable lessons can often be learnt from any potentially risk-bearing event. Although this is true of all operational safety issues, it is arguably of particular significance for runway collision avoidance.

Safety Recommendations

<u>To Aircraft Operators</u>

- Pilots should be provided with a recurrent overview of runway incursion and collision risk illustrated by regularly updated information on recent near miss events which can provide valuable lessons.
- Relative runway collision risk could be included in the overall aircraft type-based airport operational safety assessments which some operators use to categorise higher risk airports as 'B' or 'C'. This could cover greater than normal risk from airside driver procedures and use of languages other than English as well as an objective review of risk at charted "hotspots" which unfortunately are designated on widely varying assessments of actual risk. Captains can then be provided with an appropriate special briefing note for airports assessed as Cat 'B' and familiarisation and/or simulator training for airports assessed as Cat 'C' which might also require a Captains-only handling restriction.
- Operating procedures must ensure that all clearances relating to runway occupancy for taxi, takeoff or landing are both verbalised and, if complex, fully understood by both pilots. A high level of situational awareness of other potentially relevant traffic must also be maintained visually, by passive monitoring of radio communications and by reference to any available display of ground traffic.

<u>To Pilots</u>

- Ensure that both takeoff and landing briefings include an active review of any perceived higher risk of runway collision whatever its origin and maintain strictly operational flight deck communications.
- Ensure you are aware from ATIS content or direct query whenever intersecting runways are in simultaneous use and pay close attention to radio communications if this is the case.
- Challenge any runway-related ATC clearance which is in any way unclear and always ask for a repeat of any such clearance if either pilot is unsure what it was or if it was potentially ambiguous.
- Low visibility conditions justify an explicitly heightened awareness of the risk of collision.
- Never cross lit red stop bars unless ATC have provided conclusive assurance that it is safe to do so.
- When NOTAM advice of work in progress involves partial or complete runway closure and/or closure of runway access taxiways, ensure that any potential increased collision risk is briefed.
- Acceptance of takeoffs which mean entering via a Rapid Exit Taxiway (RET) primarily intended for use by opposite direction landing traffic should be accompanied by maximum situational awareness on the part of both pilots.
- Be aware that vehicles, including those towing aircraft, may not be on the runway controller's frequency so any conflict avoidance in response to ATC/ driver error may rely on seeing the problem.
- If runway occupancy is permitted using local language radio communications as well as aviation English, then effective risk mitigation by monitoring TWR/GND communications may be insufficient.

[6] see: https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/106806/pdf [download first to open]