RUNWAY CLEAR

by Captain David Charles & Captain Andrew Elbert
"Runway Clear" is a routine call made on the flight deck prior to entering the runway. That sounds simple & effective. Visually clear to see if there are any aircraft, vehicles, persons, wildlife, etc., on the runway and then line up. But is it always that simple & effective? While obvious visual impediments exist during inclement weather & LVPs, there are other less obvious visual impairments that may prevent the crosscheck and reassurance that the runway is truly clear of any hazards.

Two of the main contributing factors to runway incursion incidents are lack of situational awareness and complacency.

One of the best practices, contained in one of the Airbus series of Flight Operations Briefing Notes – *Preventing Runway Incursions*[1], is "visually scan to the left and the right and check that approach path is clear of traffic". But is that visual scan always giving you all the information you think it is. It's easy to become complacent and assume simply carrying out all the good practices will keep you safe every time. Complacency can be hiding even in the best SOPs.

The renowned "Bristol Hump," whilst a hindrance to landing perfectionists on Runway 09 at western England's busiest airport, hides a much greater threat – one that exists to various

degrees at many other airports and which is not always obvious to visiting, or even based aircrew – Runway Incursion (RI).

When pilots line up on Bristol's Runway 27, they are faced with a picture not unlike an old Royal Navy Harrier ski jump. The problem is that the end of the runway is not at the top of the hump.

The topography of the runway means that when lined up for departure on Runway 27, pilots cannot see the threshold and runway exit at the 09 end of the runway. Although they can see commercial airliners vacating, the sight line is enough to hide a vehicle or a light aircraft.

Even in daylight at relatively simple airports, 'Murphy's Law' prevails – -no matter how carefully you have

taxied, no matter how carefully you have briefed and executed your route to the runway, no matter how carefully you have identified the correct runway and carried out the line-up procedure, you still can't see through a hill! In such circumstances, part of an operator's CRM and, where used, Threat and Error Management (TEM) should ensure that when one cannot truly survey the entire runway, pilots and ATC must mitigate complacency and perform SOPs with discipline and precision.

Ground movements at any airport can be a surprisingly complex business. Controllers have a strategic overview and tactical game plans to orchestrate

1- see http://www.skybrary.aero/bookshelf/books/185.pdf

and synchronise movements of aircraft, ground vehicles and airport personnel. As pilots, our main lines of defence against runway incursion and ground collision (GCOL) events are SOP, sterile flight decks, and CRM. Within this toolbox, situational awareness (SA) is the key. SA is not only about knowing where you came from, where you are presently and where you are going, it also requires one to develop a mental model of where everyone else is and where they are going. Essentially, pilots need to comprehend and appreciate the controller's plans and instructions, especially when time does not permit broadcast of the "big picture" over the frequency.

To make sure one keeps the "big picture," it is vital for all persons, aircraft, and vehicles manoeuvring around the airport to listen out on frequency and use it to manage their mental model and maintain SA regarding airside movements. This is especially important when you are unable to physically see what lies behind another terminal, hangar, airport structure, or even over the next hill or behind the tree line.

Pilots are made aware of areas that controllers are not visual with as these are depicted on airport charts. This allows a threat to be identified, briefed and planned for when expected taxi routes and stands exist within one of these areas. Pilots can utilise TEM to anticipate and recognise threats associated with areas where aircraft or ground vehicle movements cannot be visually monitored by the ground controllers. Whilst areas of restricted visibility are usually noted on aeronautical charts, rarely do these charts advise when airfield topography may pose a threat to being able to visually confirm the route or runway is clear.

Visual illusions work so well because our cognitive processes make convenient assumptions about objective reality based on the 3D visual stimulus received. The core of Situational Awareness is the effective extraction of information from the environment. Especially in areas with line-of-sight restrictions, these human factor realities and GCOL & RI imperatives dictate that pilots and controllers alike should incorporate these risks into their CRM and TEM. Whether anchored in the old adage that "forewarned is forearmed" or in TEM's "anticipate, recognise, recover," SA is fundamental for the maintenance and synchronisation of the mental models involved during airport ground operations.

For both pilots and controllers, remembering that up to half of our mental model comes through aural cues and that receiving,

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comprehending, and utilising that information is essential to SA and GCOL/RI mitigation. Every pilot knows how important it is to monitor the active frequency on the ground. It not only contains the instructions needed to manoeuvre as your own aircraft, but also as an aircraft safely and securely synchronised within an airport's entire system. A call to another aircraft or ground vehicle could be the information that alerts you to a potential threat or conflict lurking just around the next corner or beyond the runway hold line. Hence, the necessity for SA and a shared mental model.

We are certain we can agree that SA and a shared mental model can be best built and synchronised by following established procedures, utilising CRM and incorporating the real-time visual and aural inputs received during ground operations. Back at the beginning, I mentioned the often overlooked visual threat associated with obstruction in the normal line-of-sight and one must also not forget the main threats to communication – interruption and distraction.

Taxiing is a critical phase of flight and is rightly seen as such by Safety Regulators. Although normally the shortest segment of a flight duty, there are plenty of regulated activities that pilots are required to do whilst manoeuvring the aircraft on the ground that can take a proportion of their attention away from monitoring the radio communication frequency and keeping a good visual lookout such as briefings, checklists and performance crosschecks. Some airlines even require crews to confirm final load sheet figures with the handling company after pushback and of course there are always vehicles, personnel, ground equipment, wildlife hazards, and aircraft to scan for – especially distracting when there is a new, distinctive livery on the apron which can tempt a sterile flight deck environment!

It should be recognised that any distraction is an interruption of one or both pilots' capacity to monitor the surrounding environment and maintain SA. It is also natural human behaviour to chat. If the airport is busy or there is a significant delay at the holding point before departure, pilots must overcome a natural tendency to break the silence with 'idle' conversation. The threat to safe operations is that general conversation is distracting. Thus, regulators and operators alike promote "sterile flight deck" concepts during critical phases of flight so that pilots' mental models, which are supporting safe operations, are protected.

Sterile flight decks restrict communication to standard operating procedures, checklists, and discussions necessary for the safe conduct of the flight. Discussions of the ground situation and the on-going airport environment and movements are, however, encouraged. To discuss the "Bristol Hump" and its potential impact on RI during taxi-out does not violate a sterile flight deck environment as it aligns with safety, TEM and sterile flight deck concepts. If the potential threat is one of runway topography, then discussing what may lie over the horizon is essential to maintain the mental picture since the visual picture which will be encountered will be restricted. Which aircraft have been cleared to line up? Where was the landing light aircraft supposed

to vacate? Did the landing aircraft vacate the runway? TEM combined with proactively monitoring the ATC frequency can provide an aural alert and anticipation of potential conflicts.

Human factors add another challenge, as even when being presented with the same information whilst within the same environment, not everyone will construct the same mental picture. It is therefore vital for pilots and controllers to communicate and synchronise their mental model so that any differences can be identified and resolved prior to an incident or accident. Numerous flight safety studies have highlighted the negative consequences associated with assumptions. In aviation, one should never, ever, assume and CRM best practices demonstrate the effectiveness of advocacy. So, if you are unsure or the clearance or SA, ask the question!

During a sterile flight deck period, both pilots should remain on the operational frequency unless there is an overriding safety related or operationally imperative situation. If away from it, once back on frequency, pilots should check with their colleague what they've missed – maybe new instructions and traffic movement updates. Sharing the latest "big-picture" once both pilots are on frequency again is essential to re-establish and re-synchronise SA.

Has the runway inspection vehicle vacated the runway? Can I see the full length of the runway from my position? Did ATC say line up or cleared for takeoff? Wasn't there a runway inspection in progress while I was off the frequency? A simple operational discussion can be a most effective RI safety net.

One of the key recommendations from the EAPRRI[2] document is that all runway operations should be conducted in aviation English where possible. While various reasons are given for not doing this everywhere, such as when English language proficiency is not required to obtain airport driving permits, the use of multiple languages on an ATC frequency certainly hinders the ability to develop the required SA and the effectiveness of using TEM to mitigate RI. Take for example, Airport Z, a busy national general aviation (GA) airfield with frequent international commercial traffic movements which all occur on a sloping runway.

There are three major threats which increase the probability of Murphy's Law resulting in RI:

- The GA traffic and ground ops all communicate in the national language.
- From the threshold of Runway XX one cannot see the Runway YY threshold, nor the adjacent GA grass runway.
- Airline traffic can only enter the runway at the mid point and must back track down the hill to the XX threshold.

As most aeroplanes are not equipped with rear view mirrors or cameras, it is hard to keep a mental picture of what is happening behind your aircraft, especially if one cannot use ATC communications and their aural inputs to model it. Developing technologies, however, offer to mitigate many of the obstacles to safe operations which often lead to RI when SA and CRM fail to mitigate or trap the causal factor(s).

Aircraft based RI mitigation systems and runway incursion monitoring systems at airports give a further layer of protection against runway incursion, however, SA and CRM will continue to be the most effective safety nets. Whereas technological safety nets by design normally increase SA because of their functional reliability, this very reliability can foster complacency-creep which can easily neutralise any benefits gained by their introduction.

In summary, every day pilots and controllers perform with extraordinary discipline and precision to mitigate and prevent RI events which can easily occur when people lose their SA or become complacent because of the well-trained, finely-tuned, highly reliable systems and individuals which operate in the aviation industry. Despite the arrival of many high-tech safety nets which have been shown to mitigate RI, pilots and controllers alike still need to make use of basic sensory cues (visual, aural), standard procedures (sterile flight deck concepts), CRM (SA, communication, advocacy), TEM (anticipate, recognise, recover), or – in two words – basic airmanship, to prevent RI events – especially when confronted with the "Bristol Hump" or similar constraints to the "Mark-One" eyeball. ↩

2- see: http://www.skybrary.aero/index.php/European_Action_Plan_for_the_Prevention_of_Runway_Incursions_(EAPPRI)

...why all the fuss...
They seem pretty
separated from here...