AIR TRAFFIC CONTROL AND RUNWAY SAFETY ANS PERSPECTIVE

By: Raúl Alexis Samaniego Trotman, B.A.

ANS Quality and Safety Manager

Air Navigation Direction

Civil Aviation Authority of Panama

rsamaniego@aeronautica.gob.pa / romeosierra14@hotmail.com

Office phone 501-9804 / Fax 501-9848 /9809

Cel. phone 6719-7001

Air Traffic Control and Runway Safety ANS Perspective

▪The objective of this presentation is to highlight some of the factors in which Panama ATCS is contributing to prevent accidents/incidents involving runway incursions.

▪To highlight the ATC point of view following ICAO provisions and propose some remedial measures for mitigating the inherent risks.

Definition of Runway Incursion

The Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, ICAO Doc. 4444) defines a runway incursion as:

"Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft"

Air Traffic Control and Runway Safety ANS Perspective

Types of Runway Incursions

Any investigation of runway incursions must attribute the occurrence to one or more of the following error types:

Operational Errors	Pilot Deviations	Vehicle/Pedestrian Deviations
•An operational error (OE) is an action of an Air Traffic Controller (ATC) that results in: • Less than the required minimum separation between two or more aircraft, or between an aircraft and obstacles (obstacles include vehicles, equipment, and personnel on runways). • An aircraft landing or departing on a runway closed to aircraft.	•A pilot deviation (PD) is an action of a pilot that violates any Aviation Regulation. For example, a pilot fails to obey air traffic control instructions to not cross an active runway or runway in use when following the authorized route to an airport gate.	•A vehicle or pedestrian deviation (V/PD) includes pedestrians, vehicles or other objects interfering with aircraft operations by entering or moving on the runway movement area without authorization from air traffic control.

Runway Incursion
Severity Categories

Operational dimensions affecting runway incursion severity:

Proximity of the aircraft and/or vehicle	Geometry of the encounter	Evasive or corrective action	Available reaction time	Environmental conditions, weather, visibility and surface conditions	Factors that affect system performance

Increasing Severity →

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

Typical Assessment Scenarios
Category ?

Typical Assessment Scenarios
Category D

8000 ft.

Hold-Short Line

1

2
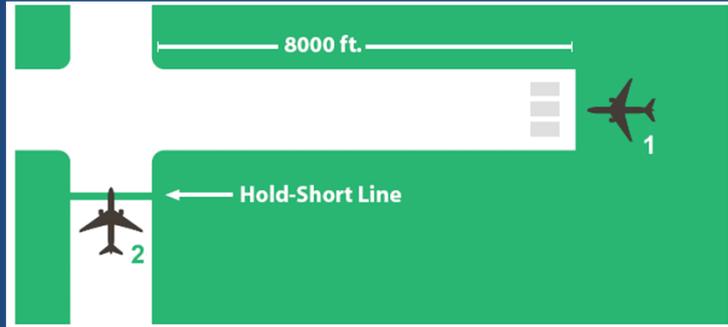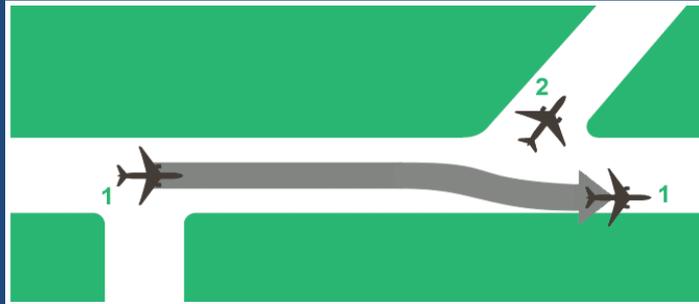
The potential for a collision is low, but by definition, a Runway Incursion has taken place.

Typical Assessment Scenarios
Category ?
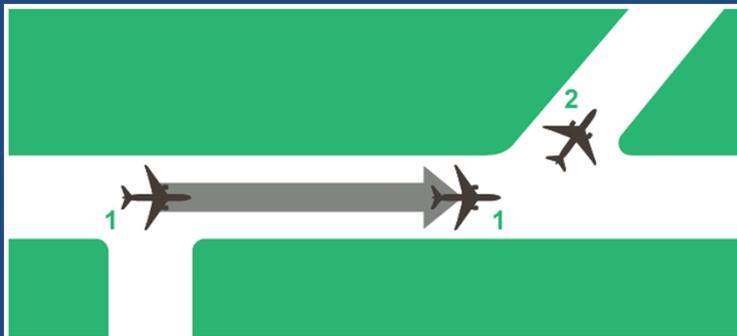
2

1

1

Typical Assessment Scenarios
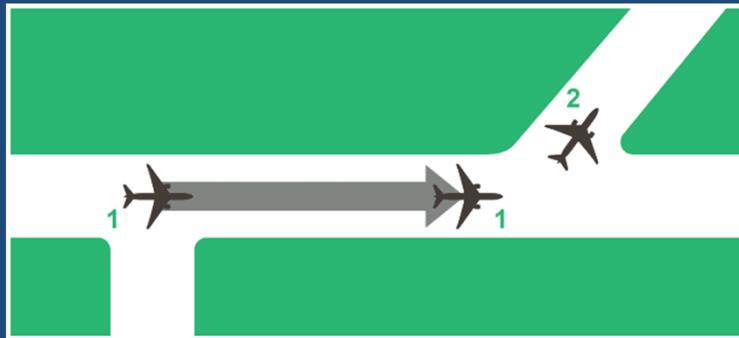**Category <u>A</u>**

The potential for a collision is high and is typical of a Category A runway incursion.

Typical Assessment Scenarios
Category <u>?</u>

Typical Assessment Scenarios
Category <u>B</u>

Separation decreases and there is a significant potential for a collision.

From an ATC point of view, the following aspects will be addressed:

- **ATC procedures**
- **Aeronautical Information Services-Aerodrome charts**
- **Radiotelephony phraseology**
- **Language proficiency**
- **Aerodrome lighting and markings**
- **ATC equipment checks**
- **Operational aspects**
- **Safety management-safety culture**
- **Investigation of incidents**
- **Meteorological conditions**
- **Human factors: Human performance/Situational awareness, Human-Machine interface**

ATC Procedures

- Aerodrome control towers shall issue information and clearances to aircraft under their control to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome with the object of preventing collisions between:

  - Aircraft flying within the designated area of responsibility of the control tower, including the aerodrome traffic circuits
  - Aircraft operating on the manoeuvring area
  - Aircraft landing and taking off
  - Aircraft and vehicles operating on the manoeuvring area
  - Aircraft on the manoeuvring area and obstructions on that area

ATC Procedures

- Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area.

- Watch shall be maintained by visual observation, augmented in low visibility conditions by radar when available.

- In the event that the aerodrome controller observes, after a take-off clearance or a landing clearance has been issues, any obstruction on the runway likely to impair the safety of an aircraft taking off or landing, such as a runway incursion by an aircraft or vehicle, or animals or flock of birds on the runway, appropriate action shall be taken as follows:

  - In all cases inform the aircraft concerned of the obstruction and its location on the runway
  - Cancel the take-off clearance for an aircraft which has not started its roll
  - Instruct a landing aircraft to go around

Aeronautical Information Services-Aerodrome Charts

- Aeronautical Information Publication (AIP)
- Amendments
- AIP Supplements
- Notam
- Aeronautical Information Regulation And Control (AIRAC)
- Aeronautical Information Circulars (AICs)
- Pre-flight and Post-flight Information/Data
- Accuracy of data (WGS-84 coordinates etc..)
- Aeronautical Charts
- Aerodrome Obstacle Charts-Type A
- Precision Approach Terrain Charts
- Instrument Approach Charts
- Standard Instrument Departure Chart (SID)
- Standard Instrument Arrival Chart (STAR)
- Visual Approach Charts
- Aerodrome Ground Movement Chart
- Aircraft Parking Docking Chart
- Update of Information Follow-up

Annex 4 Aeronautical Charts (Book 31 RAC Panama) Annex 15 Aeronautical Information Services
(Book 29 RAC Panama)

Radiotelephony phraseology

- Communications for control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes:
    - Two-way radiotelephony communications facilities shall be provided for aerodrome control service for the control of vehicles on the manoeuvring area, except where communication by a system of visual signals is deemed to be adequate.
    - Voice communications- Annex 10 Vol.II (Book 34 RAC Panama)
    - In all communications the highest standard of discipline shall be observed at all times.
    - ICAO standard phraseology shall be used in all situations for which it has been specified. Only when standard phraseology cannot serve an intended transmission, plain language shall be used

Radiotelephony phraseology

ATC Read-back of procedures

- The flight crew shall read back to the air traffic controller safety-related parts of ATC clearances and instructions which are transmitted by voice.
- Other clearances or instructions, including conditional clearances, shall be read back or acknowledged in a manner to clearly indicate that they have been understood and will be complied with.
- The controller shall listen to the read-back to ascertain that the clearance or instruction has been correctly acknowledged by the flight crew and shall take immediate **action to correct any discrepancies revealed by the read-back**
- **When circumstances differ** Pilots/ATC personnel and other ground personnel will be expected to use appropriate subsidiary phraseologies which should be clear and concise as possible and designed to avoid possible confusion by those persons using a language **other than one of their national languages**

Language Proficiency

Annex 1: personnel Licensing (Book 1 RAC Panama)

1.2.9 Language proficiency

Aeroplane and helicopter pilots and those flight navigators who are required to use radio telephone aboard an aircraft shall demonstrate the ability to speak and understand the language used for radiotelephony communications.

Annex 1:

1.2.9.6: Language proficiency

As from 5 March 2008, aeroplanes and helicopter pilots, **air traffic controllers and aeronautical station operators shall demonstrate the ability to speak and understand the language used for radiotelephony communications to a level specified in the language proficiency requirements (Operational level 4). ICAO Doc. 9835**

<u>Other ICAO Provisions:</u>

That States, with a view to ensure that the level and quality of services are maintained, be invited, through their safety management programmes, to **evaluate and identify the requirement for ATC refresher courses, including English language training for air Traffic Controllers**

Aerodrome lighting and markings

A very common problem leading to confusion, while taxiing or moving about the aerodrome, is that signs and markings are often allowed to significantly weather or fade. In addition, signs and markings are sometimes also incorrectly placed.

These kind of deficiencies found in airport markings and visual aids have been identified as a **leading problem affecting runway safety**.

Faded signs or incorrectly placed signs are often the result of poor maintenance schedules and improper or infrequent inspections.

It is important that a rigid and fail-safe ground maintenance schedule, one that includes an updated checklist, be established at all aerodromes. Frequent and random inspections should always be in place to gauge the effectiveness of any ground aid maintenance programme.

Aerodrome lighting and markings

- **Annex 14: Aerodromes** (Book 35 RAC Panama)
  - Enlarged version of runway holding position markings
  - Upgraded specifications on stop bars and runway guard lights
  - Use of retro-reflective materials for markings

ATC Equipment checks

As air traffic controllers, we are surrounded by electronic equipment everywhere we turn. As we look around the facility, we see communication panels, radar monitors, flight strip computers and printers, weather monitors and a plethora of other items there to give us the tools we need to effectively do our jobs. As the shift starts, there are a few things we need to do to ensure safe operations.

Just before the shift starts, a check of all equipment should be done to confirm that it is all in working order.

Such checks would include: verification that all available lighting is working properly, and that all communication equipment is functioning. If the control tower is equipped with surface movement radar or other advanced surface movement guidance and control systems, these should be checked to ensure that they are serviceable. It is better to find a malfunction in the equipment now, than to wait until difficulties arise and an incident occurs.

As the pre-shift equipment check is being completed, any discrepancies found must be logged in a maintenance log book for corrective action to take place. This basic system has proven to be an effective means of communicating discrepancies to the correct department for repair.

It is also important that all visual aids on the aerodrome are checked on a regular basis to ensure they are working properly and are easily visible. This task is normally undertaken by aerodrome maintenance staff.

Operational aspects

- Procedures for Aircraft Operations (PANS- OPS)
- (Vol. 1, Part IX, Chap. 1) : Aerodrome Surface operations aimed at addressing vulnerabilities in human performance and maintenance of situational awareness during surface operations.
- Provisions require that operators ensure flight personnel are aware of risk factors in the aerodrome surface operations

Some other ICAO provisions :

- Where necessary, standard routes for taxiing aircraft should be established on an aerodrome between runways, aprons and maintenance areas. Such routes should be direct, simple and where practicable, designed to avoid traffic conflicts
- Standard routes for taxiing aircraft should be identified by designators distinctively different from those of the runways and ATS routes.
- Annex 2: Rules of the Air (Book 10 RAC Panama)
  - Aircraft shall stop and hold at all runway holding positions
  - Aircraft shall not taxi onto maneuvering area without clearance
- Annex 11: Air Traffic Services (Book 28 RAC Panama)
  - Movement of persons and vehicles must be controlled by the control tower

Safety Management-safety culture

2.27 **ATS Safety Management** -Annex 11- Air Traffic Services (Book 28 RAC Panama)

2.27.3. States shall require, as part of their State Safety Programs (SSP), that the air traffic service provider implant a Safety Management System (SMS) to be acceptable to the State and that, as minimum:
(a) identify safety hazards;
(b)ensure the implementation of the necessary corrective measures to maintain an acceptable level of safety in their operations;
(c) provide permanent monitoring and periodic evaluation
for the effectiveness of the safety management; and
(d) have as a goal the continuous improvement of the general performance of the safety management system.

Safety Management-safety culture

- States shall implement systematic and appropriate safety management programmes to ensure that safety is maintained in the provision of ATS within airspaces and at aerodromes

- When applicable, safety levels and safety objectives shall be established on the basis of regional air navigation agreements. The following examples of measures which could be used to express the acceptable level of safety:

    A maximum probability of an undesirable event, such as loss of collision. Loss of separation or **runway incursion**

Investigation of incidents

- Non-punitive system must be established
- Definition of Air Traffic Incident
- Reporting Procedures
- Investigation Process
- Incident Report Record-keeping
- Preliminary Documentation
- Follow-up Investigation Process
- Final Report Documentation
- Analysis of ATS Incidents
- Return to Operational Duties
- Release of Information

Meteorological conditions

Because weather is so unpredictable, it is important for ATC to monitor the movements of weather patterns throughout the greater aerodrome area, in co-operation with the meteorological office assigned to support operations at the aerodrome. As deteriorating weather moves into the area, controllers and pilots alike must maintain the highest level of alertness. There are a few things controllers can do to help stay alert and up-to-date during low visibility operations.
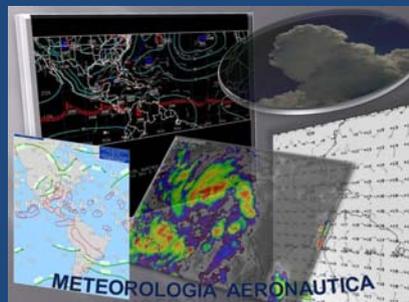
Meteorological conditions

The use of advanced surface movement guidance and control systems is invaluable during periods of low visibility operations(If available). Such equipment may allow the controller to know the precise location and movements of aircraft and vehicles on the aerodrome. And since most types of this equipment have audible warning proximity alarms associated with them, many runway incursions can be prevented by merely monitoring the system regardless of the weather conditions, making sure it is "on" at all times. In particular, this type of equipment may be helpful in places on the manoeuvring area that cannot be easily seen by the control tower.

Operations during darkness are another concern for controllers, pilots and vehicle drivers. Controllers normally sit high above the aerodrome, affording them the best view possible. From such a height, aircraft and vehicles can more easily be distinguished from other objects on the airport than from points on the ground. In view of that it is more difficult for aircraft and vehicles to find their way around the airport in darkness, extra care must be taken by ATC in the control of aircraft and vehicles on the aerodrome from dusk to dawn.

Human factors: Human performance/Situational awareness, Human-Machine interface

- **Human performance**

    Skill-based

    Routine tasks, No conscious decision making process involved

    Rule-based

    Has already encountered the situation before and knows a method of addressing the problem/reaching a solution

    Knowledge- based

    Reason based on knowledge of general principles in order to develop a course of action. In case of new situations for which ready-made answers are not available

Human factors: Human performance/Situational awareness, Human-Machine interface

Stress can be defined as a mentally or emotionally upsetting condition occurring in response to adverse external influences. Such symptoms can include increased heart rate, a rise in blood pressure, muscular tension, irritability and depression.

Stress is something that all people have; however, it is inherent to some jobs in particular. Air traffic control is one of these jobs. Most controllers are under constant stress throughout the work day as they try to delicately balance the "orchestra" of airport operations.

Human factors: Human performance/Situational awareness, Human-Machine interface

When a person is under a great deal of mental anguish or pressure in his or her personal life, he or she should carefully consider whether it is appropriate to take on operational duties. The consequences of working under mental anguish or pressure may be very serious indeed.

Finding an outlet that fits your interests and lifestyle is one of the keys to being a successful controller. One essential aspect is getting sufficient rest before going into work. This can help a person maintain focus at work, and substantially facilitate maintaining situation awareness.

Human factors: Human performance/Situational awareness, Human-Machine interface

- It is useful to think in terms of a human-centered philosophy of ATC automation
- Such philosophy considers automation as **ASSISTING** and **NOT REPLACING** the controller

Conclusions for Air Traffic Control and Runway Safety

Bad system design equals human error equals incidents and accidents. While it is true that some error is due to individual negligence or willful misconduct, in the great majority of instances, it is the operational system itself that is at fault. Whether they be pilots, Air Traffic Controllers or vehicle drivers, those at the operational level are generally trying to do their best, but sometimes make mistakes anyway.

Many times this can be traced back to some part of operations or training that is deficient to the point they virtually ensure people will frequently make errors. Although individuals must always be accountable for their actions, the real solution is to go back to the *source of the mistakes and correct that. In some cases this may be as simple as* repainting and highlighting hard-to-see markings that have often been overlooked by taxiing pilots.

Or it may be a change in the training curriculum for drivers to address a weak spot in their instruction. One guiding concept is to look beyond punishing individuals for mistakes, so as to address the flaws in the system that prompted the mistakes in the first place.

Conclusions for Air Traffic Control and Runway Safety

Factors that continuously need to be reinforced to keep safety as the first objective of our ANS/ATC Organization:

- Good AIS / Aerodrome Charts System/organization
- Reliable communications means/facilities
- Use of ICAO standard phraseology
- Proficiency in the use of the English language
- Development of a safety and just culture
- Non-punitive system of incident reportingAvailability of reliable/ permanent meteorological information
- Keep track of human factor elements in the human- machine interface
- Automation is an aid to ATC and not a replacement
- Service providers shall ensure that ATC/ground personnel are given the necessary tools and training with a view to mitigate the risk of runway incursions
- Appropriate marking and lighting aids be available
- Easily understood procedures to be developed

Thank you for your attention!