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Runway Incursion as a Factor Affecting the Reduction of Flight and Air Transportation Safety

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Annotation

The article deals with the introduction of new technologies in the field of air traffic management and modernization of technical means, as well as the improvement of the SMS of the Uzaeronavigation Center in accordance with international ICAO standards. The modernization of technical means will allow the air navigation service of Uzbekistan to work within the framework of the basic requirements and standards recommended by ICAO for international air transportation, as well as to improve the safety of flights and air transportation.

Keywords: Aircraft, runway, safety of flight, air transportation,runway incursion,runway safety, risk-based safety management,aviation risk identification.

Many airports were constructed more than 30 years ago, during these years aviation traffic has grown exponentially. Many airports around the world still have the original signs and markings, and they are no longer ICAO compliant. Leaving a pilot to interpret the meaning of these non standard signs and markings is an unnecessary hazard that may lead to a significant safety event. IFALPA considers the use of non standard signs and markings a threat for its pilots and is requesting their standardization around the globe.

Runway Safety

While appropriate operational procedures are essential, airport design that eliminates runway crossings are what IFALPA is asking from airport operators around the world. Reducing runway safety risk remains a top priority for the FAA. The FAA created the Surface Safety Metric (SSM) to more accurately identify the greatest risks in the runway environment. Unlike previous metrics that focused on the number and severity of runway incursions, the SSM incorporates all types of relevant events that occur in the runway environment. The Surface Safety Risk Index is the methodology used to assess the severity of risk of those events. In October 2019, the SSM became the FAA's primary metric for measuring and reporting the safety performance of the National Airspace System (NAS) in the runway environment.

Risk-Based Safety Management

As the FAA evolves from compliance-based safety assurance methodologies to Risk-Based Safety Management (RBSM), we are able to focus on a systemic view of the runway environment that leads to the identification of risk before it becomes an event. RBSM manages aviation safety systemically through a continuous and comprehensive application of investigative, reporting, analysis, mitigation, measurement and feedback endeavors through both dynamic and static processes. It enables predictive capabilities through the early recognition of risk data patterns, which drives preventive risk mitigation.

Aviation Risk Identification and Assessment

Aviation Risk Identification and Assessment (ARIA) is an automated tool that supports risk-based, data-driven decision-making, providing better insight into potential risk in the NAS. At surface surveillance-equipped airports, the ARIA surface module will use surveillance data to

identify and categorize potential risk of collision between an aircraft and moving objects (i.e., another aircraft, vehicle, etc.) within a predetermined area on or surrounding the airport environment. The system will continually assess and capture data about such encounters based on vertical, lateral, and speed components. This data will enable safety experts to make better-informed, risk-based, data-driven decisions about safety in the airport surface environment. ARIA surface module pre-deployment processes are underway with full deployment on target for 2022.

Collaboration is Key

The FAA convened the Runway Safety Council (RSC) to fundamentally change the existing safety culture and move toward a systemic proactive management strategy that involved cooperation throughout the FAA and among the different segments of the aviation industry. By applying the formalized and proactive approach of the Air Traffic Organization's (ATO) Safety Management System, the RSC is advancing the shift from a compliance-based safety system to a risk-based, data-driven, integrated systems solution to runway safety.

Collaboration with the aviation community is a key component of runway safety. The RSC includes aviation stakeholders from across FAA Lines of Business like Airports, Aviation Safety, and the ATO, FAA employee labor organizations like PASS and NATCA, as well as industry representatives like aircraft operators, airline representatives and flight instructors.

Runway Safety Action Teams

Runway Safety Action Teams (RSAT) bring local airport stakeholders together at least once a year to identify risks to surface safety at that airport and develop plans to mitigate or eliminate those risks. RSATs provide the foundation of the Runway Safety Program at individual airports. The RSAT meetings are the primary forum for pinpointing and addressing airport-specific risk in the surface environment. The product of a RSAT meeting is a Runway Safety Action Plan in which the stakeholders document and agree to pursue specific actions intended to improve surface safety.

RUNWAY SAFETY TECHNOLOGIES

Runway Status Lights (RWSL)

The FAA developed RWSL technology to increase situational awareness for aircrews and airport vehicle drivers, and thus serve as an added layer of safety. A RWSL system derives traffic information from surface and approach surveillance systems and illuminates red in-pavement airport lights to signal a potentially unsafe situation. Runway Entrance Lights are deployed at taxiway/runway crossings and illuminate if it is unsafe to enter or cross a runway. Takeoff Hold Lights are deployed in the runway by the departure hold zone and illuminate red when there is an aircraft in position for departure and the runway is occupied by another aircraft or vehicle and is unsafe for takeoff. RWSL is operational at 20 U.S. airports. Learn more about RWSL.

Airport Surface Detection Equipment, Model X (ASDE-X)

ASDE-X integrates data from a variety of sources, including radars, transponder multilateration systems and Automatic Dependent Surveillance – Broadcast (ADS-B) to provide accurate target position and identification information and thus give controllers a more reliable view of airport operations. ASDE-X provides tower controllers a surface traffic situation display with visual and audible alerting of traffic conflicts and potential collisions. ASDE-X is operational at 35 airports in the U.S. There is more information about ASDE-X on the FAA website.

National Runway Safety Plan (NRSP)

The FAA's top priority is maintaining safety in the National Airspace System with great emphasis placed on reducing runway safety risk. The National Runway Safety Plan (NRSP) aligns the strategic priorities of the FAA's Runway Safety Group with established Safety Risk Management principles. The NRSP describes how the FAA, airport operators, and aviation industry stakeholders collaborate and use data-driven, risk-based decision making to enhance the safety performance in the runway environment and the airspace.

The Regional Runway Safety Plans support the NRSP by focusing on regional and airport specific efforts that contribute to the overall impact of the Runway Safety Program.

From the Flight Deck and the Runway Safety Pilot Simulator

FAA's From the Flight Deck video series provides pilots with actual runway approach and airport taxiway footage captured with cockpit mounted cameras, combined with diagrams and visual graphics to clearly identify hot spots and other safety-sensitive items. From the Flight Deck videos are available for airports nationwide, with new locations regularly produced, as well as videos on general aviation safety challenges pilots may encounter.

FAA's Runway Safety Pilot Simulator video series is a self-guided resource to assist flight instructors with teaching student pilots surface safety best practices, before they step foot into the cockpit. It allows student pilots to navigate on airport surfaces while communicating with air traffic control and following instructions provided. The scenarios are interactive and allow viewers to make decisions based on air traffic control instructions.

In October 2007, the Federal Aviation Administration skipped its own definition of "runway incrusion" and adopted the above. The difference between the two was, "that ICAO defines runway intrusion as any unauthorized intrusion on a runway, regardless of whether the aircraft presents a potential conflict. For the FAA, an incident without an aircraft in a potential conflict–such as an unauthorized aircraft crossing an empty runway–was defined as a "surface incident" and not a runway intrusion."

In the Allianz Global Corporate study & Specialty (AGCS) under the title "Aviation Risks 2020: Safety and the State of the Industry" focuses on the development of flight safety in commercial aviation worldwide.

The US Federal Aviation Agency (FAA) has implemented only 10 of the 22 initiatives that it itself proposed in 2015 to solve the problem of unauthorized aircraft trespassing on runways. This conclusion was made in a report published by the US Federal Inspection Office.

The document emphasizes that in 2011-2017, the FAA recorded an 83 percent increase in the number of incidents, including very serious ones, when two aircraft approached at a distance of only a few feet. The audit showed that the Agency had achieved the goal of training pilots on the topic of designations and other visual assistance at high-risk facilities, and also updated the rules of conduct for pilots on the runway and in the airspace. However, other initiatives have come to a standstill, mainly due to the lack of funds for implementation and the slow introduction of modern technologies.

Among the unfulfilled initiatives are measures to reduce the risk of errors related to the fatigue of dispatchers and pilots, as well as testing new NextGen technologies for transmitting instructions during operations on the taxiway, such as DataComm.

AGCS analysis of more than 50,000 aviation insurance industry claims worth more than €14.8 billion ($16.3 billion) over the past five years shows that collision/accident incidents account

for more than half of the value of all claims (57%), equivalent to €8.4 billion ($9.3 billion) and more than a quarter in number (27%).

To ensure the safety of flights near the ground and approach, various systems have been developed - TAWS (Warning system for approaching the ground), course-glide systems - ILS (meter range), MLS (centimeter range), radio navigation systems - Western VOR /DME and Soviet RSBN.

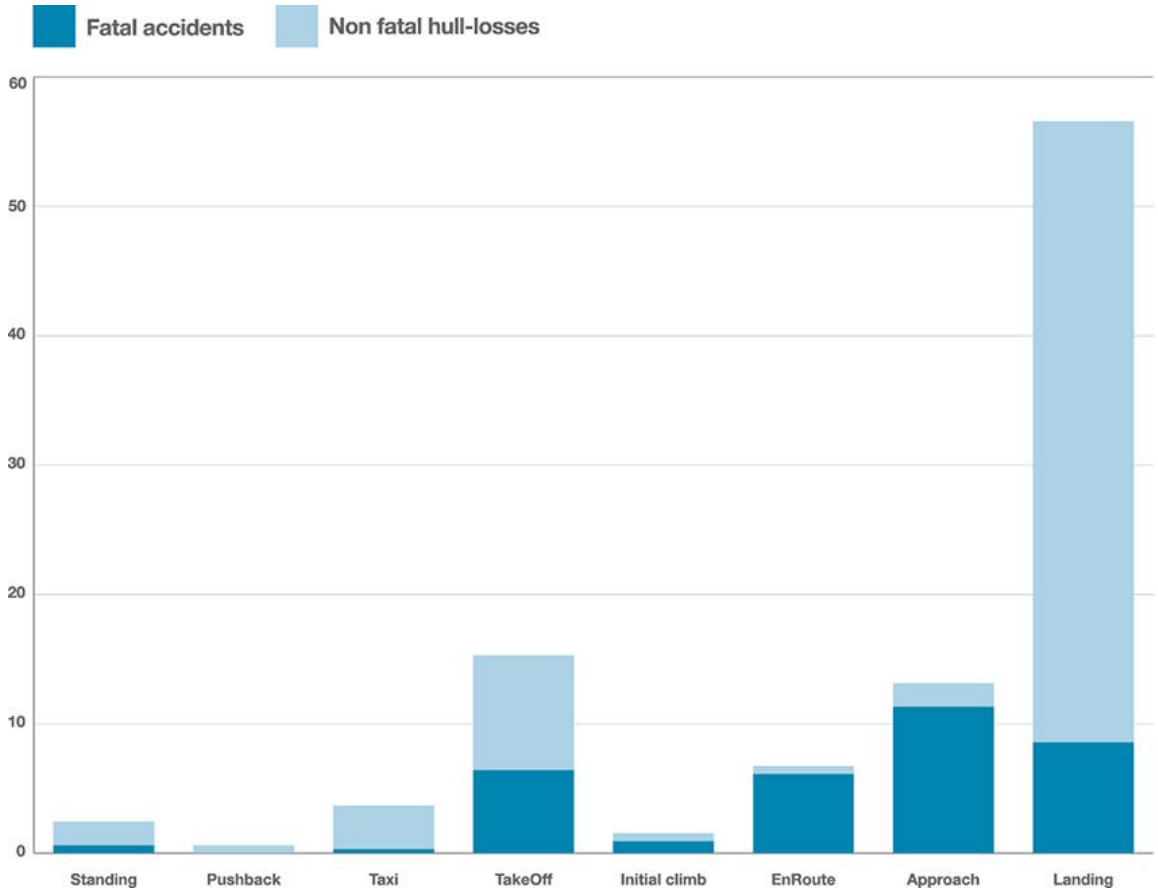

Figure 1. (As you see the most accidents cause during the Approach and Landing)

CONSIDER A FEW EXAMPLES OF THE PROBLEM OF AIRCRAFT INVASION OF THE RUNWAY OF INTERNATIONAL AIRPORTS.

• In the 1972 Chicago-O'Hare runway collision, North Central Airlines Flight 575 (a McDonnell Douglas DC-9) collided during its takeoff run with Delta Air Lines Flight 954 (CV Convair 880) while CV 880 was driving a taxi across the fog-covered runway at O'Hare International Airport in Chicago, Illinois, killing 10 people and injuring 17.

• The Tenerife Airport disaster of 1977 occurred when one of the planes turned on, KLM Flight 4805 (Boeing 747) started takeoff before it was supposed to and collided with another aircraft, Pan Am Flight 1736 (another Boeing 747). A total of 583 people died in the disaster - more fatalities than in any other accident in aviation history.

•October 11, 1984, Aeroflot Flight 3352, Tupolev Tu-154B-1 hit service vehicles on the runway attempting to land in Omsk, Russia. The ground controller allowed workers to dry the runway during heavy rain and fell asleep at work. 174 people on board the plane were killed along with 4 people in the destroyed service vehicles.

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• On February 1, 1991, USAir Flight 1493 collided with SkyWest Airlines Flight 5569 waiting on the runway, killing 34 people. The air traffic controller mistakenly assigned the arriving Flight 1493 to the runway where Flight 5569 was waiting to take off.

• Cessna Aviation 441 Flight 427/above TWA 1994, November 22, 1994: Cessna pilot error at Lambert-St. Louis International Airport. The pilot was driving a taxi to the wrong runway and was hit, departing TWA MD-80, 2 fatalities on a Cessna.

• On November 16, 1996, United Express Flight 5925 was landing at Quincy Regional Airport when the pilot of the King of Beechcraft Air began taking off on the intersecting runway. As the area was rampant, United Express pilots asked if King Air was away from the runways. They received no response except for a demand from a Cherokee Piper saying what they considered short. King Air and United Express collided at the intersection of these two runways, killing all 12 on board Flight 5925 and the pilot and passenger of King Beechcraft Air.

• On April 1, 1999, an Air China Boeing 747, Flight 9018, was traveling by taxi to an active runway at Chicago O'Hare International Airport during takeoff of Korean Air Flight 36, another 747. Flight 36 averted a collision by taking off early, passing the Air China plane 75 feet away. There were 8 people on the Air China plane, and 379 on the Korean flight.

• 1999 T. F. Green Airport runway Incursions, December 6, 1999: In low visibility at night, United Airlines 757 turned off the wrong taxiway and took a taxi to the active runway just as FedEx Express 727 took off. No collision occurred.

• Linate Airport disaster, October 8, 2001: Scandinavian Flight 686 collided on takeoff with a Cessna registered D-IEVX, which turned onto the wrong taxiway, forcing it to enter the runway.

• 2004 Indian Ocean Tsunami aftermath, Banda ACEH January 4, 2005: An Indian buffalo on the runway caused a ground collision that severely delayed auxiliary flights.

Guidance on the Prevention of Unauthorized Runway Departures adopted Standards and Recommended Practices (SARPs) in the field of safety management, which for the first time clearly addresses the issue of the role and responsibilities of senior management in relation to flight safety. Annex 6 "Aircraft Operation" provides for operators to introduce and implement an accident prevention and flight safety program.

Annex 11 "Air Traffic Services" provides for States to implement safety programs, and ATS providers to implement safety management systems (SMS). Annex 14 "Airfields" provides that the introduction of SMS by aerodrome operators is a prerequisite for aerodrome certification, and recommends that similar measures be taken at already certified airfields. Nevertheless, despite such an evolution in the approach to flight safety issues, properly selected, trained and motivated operational personnel are still the true guarantor of flight safety.

When a system fails due to unforeseen deficiencies in design, training, technology, procedures or rules, human actions are the last line of defense against hidden conditions that can overcome the means of protecting the aviation system and potentially lead to a decrease in flight safety.

Based on this broader view, it is important to avoid the danger of focusing solely on organizational issues to the detriment of human contribution to the successful or unsuccessful operation of the aviation system. Active shortcomings of operational personnel are sometimes the result of deficiencies in the system, sometimes the result of well-known and documented limits of human capabilities, but, as a rule, they are a combination of both factors.

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A real systematic approach to flight safety issues should take into account the hidden conditions in the system, as well as shortcomings at the "forefront" of flight operations. It is this systematic approach that underlies this guide.

To establish an acceptable level of safety in the UzaeronavigationCenter, an important element is the selection of appropriate flight safety indicators.

The selection of safety indicators is carried out according to the following criteria:

- if the level of security that will be characterized broadly, then choose the safety indicators that indicate the final results of the high-level system/significant consequences (quantitative) and/or the functions of the high-level system (qualitative);

- if the security level, which will be characterized by specific narrow parameters, then select the security indicators that indicate the final results of a low-level system /minor consequences and functions of a lower-level system;

In both cases, security indicators indicate the end results, processes and functions that characterize the security of the system.

After determining the safety indicators, the relevant safety targets are determined, which are considered as flight safety goals.

After selecting indicators and security targets, an acceptable level of security is established.

Safety indicators should have certain assigned values, and safety goals should provide for the improvement and/or maintenance of such values.

The scope of the SMS includes production processes, subsystems and elements of the ATS system functioning in the Republic of Uzbekistan related to security, including:

- regulatory and legal documentation regulating the activities of ATS; - maintenance of air traffic, organization of airspace, network of air routes and local air lines (VT and MVL); - radio technical support of flights and communications used in ATS;

- staffing, during the training and control of personnel retraining; - services provided by related flight support services, as well as the organization of interaction with them.

Ensuring flight safety is one of the main functions of the uZaeronavigation Center (CUAN). The policy of the Central Aviation Administration is focused on the continuous improvement of flight safety and is the basis for setting goals and objectives in the field of flight safety:

- it is being developed, formalized, analyzed, approved and put into effect in accordance with the requirements of the ICAO and the State Program for Flight Safety in the Republic of Uzbekistan;

- it is brought to the attention of all the staff of the TSU by the method of visual agitation, during vocational training, during debriefings and production meetings;

- it is analyzed by the management of the TSU from the point of view of its implementation and compliance with the established goals and objectives;

- it is posted as an informational banner for consumers.

The goal is to continuously improve flight safety indicators through the introduction of SMS in the structural divisions of the Central Aviation Administration, reducing the risk associated with air traffic services.

The job description of each head of the structural unit of the Central Administrative Unit defines the corresponding duties and responsibilities related to the functioning of the SMS, in addition to specific responsibilities related to the functioning of the unit.

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A runway incursion happens where two or more vehicles are either on the same runway or approaching the same runway which can result in a conflicting situation. This can also be defined as "An event at an airfield involving the incorrect presence or a vehicle, aircraft or person on the protected area of the surface designated for the landing and taking off of an aircraft".

The following general observations were seen to be the most common consequences:

- Mistaken entry of an aircraft or vehicle onto the runway protected area without ATC clearance
- Misidentified presence of a vacating aircraft or vehicle onto the runway protected area
- Wrong runway crossing by an aircraft or vehicle without or against ATC instructions
- Landingwithout ATC clearance
- Take-offwithout ATC clearance

Other main factors that can increase the possibility of incursions occurring include the following:

- Low visibility may increase the chance of a pilot becoming disorientated and unsure of their position whilst manoeuvring along taxiways. These conditions are also likely to restrict ATC's ability to identify and follow the aircraft visually.
- The design of the taxiway infrastructure which requires aircraft to cross an active runway to travel between its take-off or landing runway and the parking position, brings additional risk of an incident potentially occurring.
- Line ups for a series of aircraft departures from the same runway but from different entry positions could lead to an increased risk for runway incursion occurrences.
- Late changes to departure times and clearances may lead to a temporary lack of concentration in the pilot's attentiveness.
- Use of Non-Standard Terminology can lead to confusion and misunderstanding between the pilots and controllers.
- Simultaneous use of more than one Language for communications between ATC and vehicles crews.

The FAA estimates that there are approximately three runway incursions that happen every day at towered airports in the United States. The main cause for these incursions can be categorised as:

- Incorrect entry of an aircraft or vehicle onto the runway protected area without or contrary to ATC clearance
- Incorrect presence of a vacating aircraft or vehicle onto the runway protected area.

The 4 categories of runway incursions:

- **Category A** is a serious incident in which a collision was narrowly avoided.
- **Category 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.
- **Category C** is an incident characterised by ample time and/or distance to avoid a collision.
- **Category 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.

CONCLUSION: In order to reduce the risk of an aircraft collision on the runway in the conditions of Uzbekistan, There are several ways to overcome these types of situations to avoid a runway incursion event:

- Maintenance of situation awareness by flight crew and others using the manoeuvring area, specifically in respect of their own location in relation to active runways, and that of other aircraft and vehicles relative to active runways.
- Presence of standard Runway Markings and Taxiway Surface Markings and Signs
- Presence of standard Runway Lighting and Taxiway Lighting including the installation of Runway Status Lights (RWSL) and Runway Holding Point Lighting.

The use of runway incursion control systems that monitor vehicle movement at the entrance or exit of the protected area.

There are procedure's at every airport that should be followed prior to a vehicle or aircraft entering the runway area, all of which will entail ensuring clearance from Air Traffic Control is obtained. To help indicate where a vehicle or aircraft should wait for clearance to be granted there are a number if lighting aids. Airfield Mandatory sign (red), runway guard lights, and inset / elevated stopbar fixtures, all of which indicate the 'hold' position.

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