

REPUBLIC OF RWANDA



Ministry of Infrastructure

Aviation Accident and Incident Investigation Directorate

**Report on the investigation of the runway excursion incident
to Boeing B727 with registration EY-724, at Kigali
International Airport on November 13th, 2020.**

Ref AAID 2021-02

The sole objective of investigations carried out by the AAID is the prevention of accidents and incidents. It shall not be the purpose of such an investigation to apportion blame or liability.

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List of Abbreviations used in this report

| | |
|-------|--|
| AAID | Aviation Accident and Incident Investigation Directorate |
| AMT | Aircraft Maintenance Technician |
| AIP | Aeronautical Information Publication |
| AOC | Air Operator Certificate |
| ASFT | Airport Surface Friction Tester |
| ATIS | Automatic Terminal Information Service (supplying weather information to flight crews) |
| CB | Cumulonimbus clouds (clouds associated with thunderstorm activity) |
| F/E | Flight Engineer |
| FL | Flight level |
| F/O | First Officer |
| GPS | Global Positioning System |
| IAS | Indicated Airspeed |
| ICAO | International Civil Aviation Organisation |
| KGL | Three letter identifier for Kigali International Airport |
| knot | Nautical mile per hour (1852 m/ hour) |
| LOSA | Line Oriented Safety Audit |
| METAR | Meteorological Aerodrome Report |
| MSL | Mean Sea Level |
| MSN | Manufacturer's Serial Number |
| NBO | Three letter identifier for Jomo Kenyatta International airport, Nairobi, Kenya |
| RAC | Rwanda Airports Company |
| RCAA | Rwanda Civil Aviation Authority |
| RVSM | Restricted Vertical Separation Minima |
| RWY | Runway |
| TAS | True Air Speed |
| UTC | Universal Time Coordinated |
| VHF | Very High Frequency radio band |
| Vref | Reference speed |

Synopsis

On November 13th 2020, a B727-100 in cargo configuration operating under flight number TAK 270 landed on runway 28 at Kigali International Airport at 12:05 local time. Upon landing in light to moderate rain the aircraft touched down 420 meters beyond the normal touchdown point and considerably left of centreline.

During the landing roll the aircraft first crossed the left runway edge marking, subsequently the left main gear travelled through the terrain adjacent to the paved runway shoulder over a distance of 577 meters. In the course of the landing roll the crew was able to steer the aircraft back on the runway. During the runway excursion 15 runway edge lights were shattered. Apart from damage to the tires, also the tailskid mechanism of the aircraft was found heavily damaged. The tailskid plate was torn off and found on the runway. The aircraft carried a crew of five. No one was injured.

The investigation revealed that flight TAK 270 was operated unlawfully since the licenses of both pilots, issued by Civil Aviation Authority of Tajikistan, were not valid. Additionally serious discrepancies with regard to the validity of the Air Operator Certificate, the registration of the B727 aircraft concerned and the status of the operator were found.

So-called 'viscous hydroplaning' was identified as a main contributing factor for the loss of directional control of flight TAK 270. The viscous hydroplaning could occur due to a combination of a wet runway and a substantial layer of rubber deposits in the touchdown zone of runway 28.

The investigation led to the formulation of seven recommendations, aimed at:

- Preventing unlawful flight operations to airports in Rwanda;
- Assuring timely removal of rubber deposits from the touchdown zone of runway 28 at Kigali International Airport;
- Adherence to international safety standards by the State of Registration and the State of the Operator of the B727 involved in the runway excursion at Kigali International Airport.

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 General

Flight TAK 270 was a charter cargo flight from Jomo Kenyatta International Airport at Nairobi (NBO), Kenya, to Kigali International Airport (KGL), Rwanda. The flight was conducted with a Boeing B727-100 carrying the external registration mark EY-724 from Tajikistan. The aircraft identification plate in the cockpit however showed the registration 5Y-CIG from Kenya. Flight TAK 270 departed from NBO at time 08:50¹ and landed at KGL at 10:05. The landing weight of the aircraft was 63,2 tons, 10,4 tons of which was cargo load.

The cockpit crew consisted of the Captain, the First Officer (F/O) and the Flight Engineer (F/E). The Captain was the Pilot Flying during approach and landing at KGL.

Apart from the cockpit crew two additional Aircraft Maintenance Engineers (AMT's) travelled with flight TAK 270.

The Aircraft Technical Log contained no technical complaints or deferred defects.

All three cockpit crew members stated that their flight had progressed normally up to the final approach into KGL. The crew executed an ILS CAT I² approach for runway 28.

¹ All times in this report are indicated in Universal Time Coordinated (UTC). Local time in NBO is UTC+3; local time in KGL is UTC+2.

² ILS CAT I: an instrument approach whereby visual reference must be obtained at or before reaching an altitude of 200 ft above the runway threshold. Additionally an ILS CAT I approach for runway 28 at KGL requires a minimum horizontal visibility of 800 m.

1.1.2 Final approach and landing

During approach Air Traffic Control had advised the crew of flight TAK 270 about “moderate rain over the airfield”. Shortly thereafter, following a request from the crew of TAK 270, the controller confirmed that the rain was now “heavy”. At that time a preceding flight, conducted with a Bombardier Q400, had just landed on runway 28.

When Flight TAK 270 was transferred from the Approach to the Tower frequency, the Tower Controller cleared the flight for landing and reported the wind as being 020°/11 knots³.

At time 10:05 flight TAK 270 landed in light to moderate rain⁴ conditions. The aircraft touched down considerably left of centreline and approximately 420 m beyond the normal touchdown point of runway 28.

During the landing roll the left-hand landing gear first crossed the left white runway edge marking and subsequently left the paved runway shoulder. The left main gear travelled through the terrain adjacent to the runway over a distance of 577 m, thereby crossing taxiway Charlie. After having proceeded outside of the runway edge marking over a total distance of 1005 m, the crew was able to steer the aircraft back onto the runway. See Appendix 5.1 for an overview of the touchdown point and longitudinal trajectory of flight TAK 270 on the runway.

Radio communication between the Tower Controller and flight TAK 270 revealed that the Controller informed the flight crew about having damaged several edge lights on the left-hand side of the runway during their landing roll.

At that stage, on request of the crew of flight TAK 270, the Tower Controller reported the actual wind readout as being 010°/14 knots³.

Subsequently flight TAK 270 proceeded to apron stand 6, where all cargo was unloaded.

³ A landing on runway 28 with a wind from direction 020 degrees at a speed of 11 kts means 11 kts of crosswind from the right and 2 kts of tailwind.

A landing on runway 28 with a wind from direction 010 degrees at a speed of 14 kts means 14 kts of crosswind from the right and no tail or headwind component.

⁴ See paragraph 1.4 for detailed meteorological information.

1.1.3 Lateral deviation of flight TAK 270 from runway centreline

Runway 28 at KGL has a width of 45 meters. On both sides, adjacent to the surface intended for take-off and landing, the runway is equipped with paved strips, the so-called runway shoulders. Each shoulder is 7.5 meters wide, thus the lateral distance from the runway centreline to edge of the shoulder adds up to 30 meters.

The Boeing B727-100 is equipped with a nose gear and two main gears. Each gear has an axle with two wheel assemblies. The lateral distance between the main gears is 5.7 m, see figure 1 below.

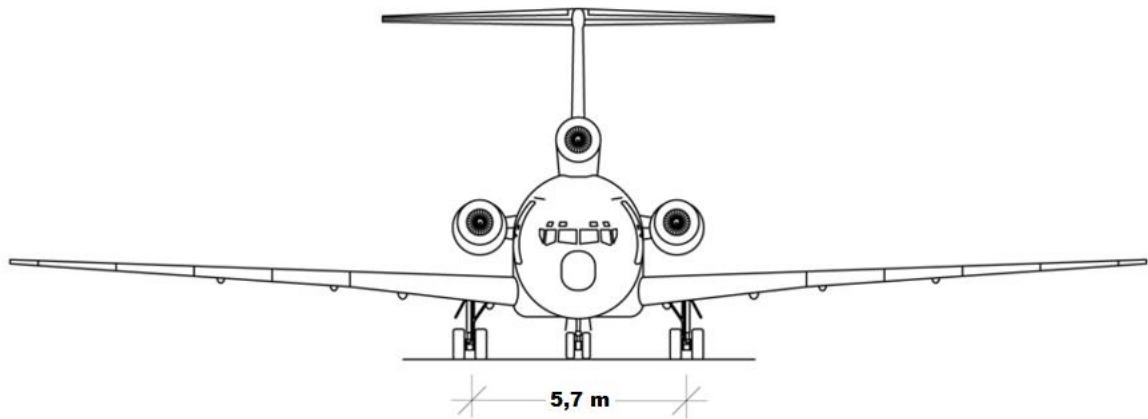


Figure 1: Lateral distance between main gears of B727-100

Flight TAK 270 reached the maximum lateral deviation from the centreline of the runway when reaching taxiway Charlie, as is illustrated by figure 2 below:



Figure 2: Track of left-hand landing gear beyond runway shoulder at taxiway Charlie. Note: picture is taken when looking in Easterly direction

At this stage the centre of the left-hand landing gear had reached a distance of approximately 1,5 m from the edge of the runway shoulder.

The B727 gear geometry in combination with the above mentioned distance of 1,5 m implicate that at that stage:

- The centre of the right-hand main gear was travelling over the runway shoulder some 3,3 m beyond the runway edge line;
- The left-hand nose gear wheel was travelling over the runway shoulder at a distance of approximately 1 m from the edge of the shoulder pavement.

1.1.4 Statements from interviews

For this investigation individual interviews have been held with the Captain, First Officer and Flight Engineer. Additionally interviews have been conducted with the Approach and Tower Air Traffic Controllers on duty, the Meteorological Officer on duty, a Bird Controller who witnessed the landing of flight TAK 270 and unloading personnel.

All three cockpit crew members indicated that the visibility during final approach was adequate: when descending through 8000 ft they could clearly see the runway. However, all three cockpit crewmembers stated that upon touchdown they were suddenly caught by heavy rain and crosswind from the right. As a result they lost visibility and control of the aircraft. The touchdown was reported as 'soft' or 'smooth', whereafter spoilers and thrust reversers⁵ were deployed without delay.

From the interviews with the Approach and Tower Controllers it was confirmed that the KGL windshear system (also see paragraph 1.7.3) had triggered a warning during approach of the preceding Q400 flight. This warning was triggered some 8 minutes before the Q400 flight received its landing clearance from Approach Control.

The final approach, landing and roll-out of Flight TAK 270 was witnessed by a Bird Controller who was seated in his car that was parked on taxiway Charlie near Hangar Nr. 1.

He stated that the heavy downpour during landing of the preceding Q400 flight had changed into light rain by the time the B727 landed, saying 'one could even stand out of the car'. There was standing water on the runway that splashed up when flight TAK 270 touched down. Shortly thereafter the Bird Controller also saw a spray of mud coming from the aircraft which made him realise it went off the runway. He then immediately called the Tower and the fire brigade.

From interviews held with unloading personnel it was established that no load had shifted during flight and that all cargo pallets were properly locked.

The unloading personnel further stated that by the time the aircraft had reached its parking position, it had stopped raining.

⁵ Note: to meet noise certification criteria the thrust reverser of the no. 2 engine had been permanently deactivated.

1.2 Injuries to persons

The runway excursion of flight TAK 270 did not result in any injuries to the crew, nor to people on the ground.

1.3 Damage to aircraft

1.3.1 Tire damage

As a result from impact with the runway edge lights on the left-hand side of runway 28, all six tires of the aircraft showed cuts, see figure 3 below:



Figure 3: Tire damage as a result of impact with runway edge lights.

1.3.2 Damage to tailskid mechanism

The B727 is equipped with a retractable tailskid. This device is meant as protection against over-rotation during take-off. In case of over-rotation the tailskid plate will first contact the runway. The device is equipped with an energy

absorber, which consists of a vertically mounted cylinder with a crushable honeycomb core. A warning light on the flight engineer's panel in the cockpit will illuminate when the tailskid cylinder is compressed after a tail strike. During the interview with the flight engineer, he stated that this warning light did not illuminate after take-off in NBO, nor after landing in KGL.

The tailskid mechanism of the EY-724 was found heavily damaged. The tailskid plate was torn off, the detached part was found on the left-hand side of the runway past taxiway Charlie, approximately at the position where the aircraft re-entered the paved shoulder of the runway, see figure 4.



Figure 4: Torn-off tailskid plate with fresh scrape marks.

The red arrow on figure 4 indicates the fresh scrape marks that were found on the right-hand aft part of the tailskid plate.

It was further found that the tailskid cylinder was not compressed and was pointing rearward instead of having its regular vertical position. Its mounting bracket inside the lower aft fuselage was cracked, see figure 5 below.



Figure 5: Broken tailskid cylinder pointing rearward.

1.3.3 Damage to no. 2 engine oil servicing panel

Additionally the access panel for oil servicing of the No. 2 engine was found ripped loose and bent, see figure 6.



Figure 6: Damage to no. 2 engine oil servicing panel.

1.4 Other damage

The runway excursion resulted in shattering of a total of 15 runway edge light fixtures and damage to the edge of the left runway shoulder, see figure 7.



Figure 7: Damage to damage to the edge of the left runway shoulder.

1.5 Personnel information

1.5.1 Captain

The Captain, who had the nationality from DR Congo, carried an Airline Transport Pilot License that was issued by the Tajik Civil Aviation Authorities, based on his original license issued by the Democratic Republic of Congo.

However, the Civil Aviation Authorities of DR Congo have responded that they did not recognise the specified license number and that they have not issued an Air Transport Pilot License (ATPL) in the name of the Captain of flight TAK 270. As a result age and flying experience of the Captain are not known to the Rwanda AAID.

1.5.2 First Officer

The First Officer, who had the nationality from DR Congo, carried a Commercial Pilot License that was issued by the Tajik Civil Aviation Authorities, based on his original license issued by the Democratic Republic of Congo.

However, the Civil Aviation Authorities of DR Congo have responded that they did suspend the specified license since June 29th 2017 due to 'some irregularities' found in his file.

According to his statement he had acquired a total of 2300 flying hours, 1600 of which were on the B727. However, these figures cannot be verified.

1.5.3 Flight Engineer

The Flight Engineer, who had a double nationality from Argentina and Bolivia, carried a F/E license that was issued by the Tajik Civil Aviation Authorities, based on his original license issued by Bolivia. According to his statement he had acquired 11.000 flying hours on the B727. The F/E also indicated that flight TAK 270 on Nov. 13th 2020 was his first flight for Zone 4 International. He had not been given any formal training on company policies and procedures prior to departure of flight TAK 270 from NBO.

The F/E carried a valid medical certificate issued by the Civil Aviation Authorities in Bolivia from which it transpired that at the time of the incident he age was 72.

1.6 Aircraft information

| | |
|---|--|
| Manufacturer | Boeing Commercial Airplanes |
| Type | B727-30C ⁶ |
| Manufacturer's Serial Number | MSN 19011 |
| Registration as marked on the exterior | EY-724 (Tajikistan) |
| Registration as marked on identification plate in cockpit | 5Y-CIG (Kenya) |
| Engines | Pratt & Whitney JT8D Series |
| Date of first delivery | March 31 st , 1967 |
| Certificate of airworthiness | Issued by CAA of Tajikistan Date of issue: April 28 th 2020 Date of expiry: April 27 th 2021 |
| Last maintenance check | Unknown |

Prior to the incident flight on Nov. 13th 2020, the EY-724 aircraft was operated on the routing Entebbe - Nairobi - Juba - Nairobi on Nov. 5th. The Aircraft Technical Log (ATL) did not show any technical complaints that were entered either during the flown stretches on Nov. 5th or during the incident flight on Nov. 13th.

The AAID did not further investigate the technical state of the aircraft, but instead focussed its investigation on the runway excursion as such including its underlying factors.

⁶ The Manufacturer's Serial Number MSN 19011 represents a B727 of the original, short version. After introduction of the extended B727-200, the original short version became commonly known as the B727-100 series. The designator '30C' indicates that the aircraft was delivered to Deutsche Lufthansa as its first operator (hence nr 30) and that it concerned an aircraft that could be converted from passenger to cargo configuration (hence the 'C').

1.7 Meteorological information

1.7.1 Automatic Terminal Information Service

The KGL Meteorological Office⁷ controls the Automatic Terminal Information Service (ATIS) of Kigali International Airport.

ATIS provides automatically generated messages that are continuously broadcasted via a VHF⁸ radio channel. The ATIS messages supply the actual weather conditions at the aerodrome in a fixed format. Pilots are expected to check the current ATIS message before departure or landing as applicable.

The latest ATIS message that was available to the crew of flight TAK 270 prior to landing at KGL was issued at 09:30. This message indicated a wind of 140°/08 knots, a visibility of more than 10 km, light rain, cumulus clouds with a base of 2.500 ft covering 60 - 90% of the sky and a chance for thunderstorm showers.

At 10:02, thus three minutes before landing of flight TAK 270, the next ATIS message was broadcasted. This message indicated a wind of 040°/13 knots, a visibility of 2000 m, moderate rain, cumulus clouds with a base of 2.300 ft covering 60 - 90% of the sky and a chance for thunderstorm showers.

1.7.2 Weather radar systems

The Meteorological Office of KGL is equipped with a comprehensive weather radar system that visualises shower activity. Although preparations have been made to provide readout of information from the weather radar system to Approach and Tower Control, the Air traffic Controllers currently do not have direct access to weather radar information.

At 10:00, the time of landing of the Q400 flight that preceded flight TAK 270 by a time span of 5 min, the KGL weather radar system displayed the following pattern:

⁷ The KGL Meteorological Office falls under the Aeronautical Meteorology Department of the Rwanda Airports Company Ltd.

⁸ VHF: Very High Frequency radio band

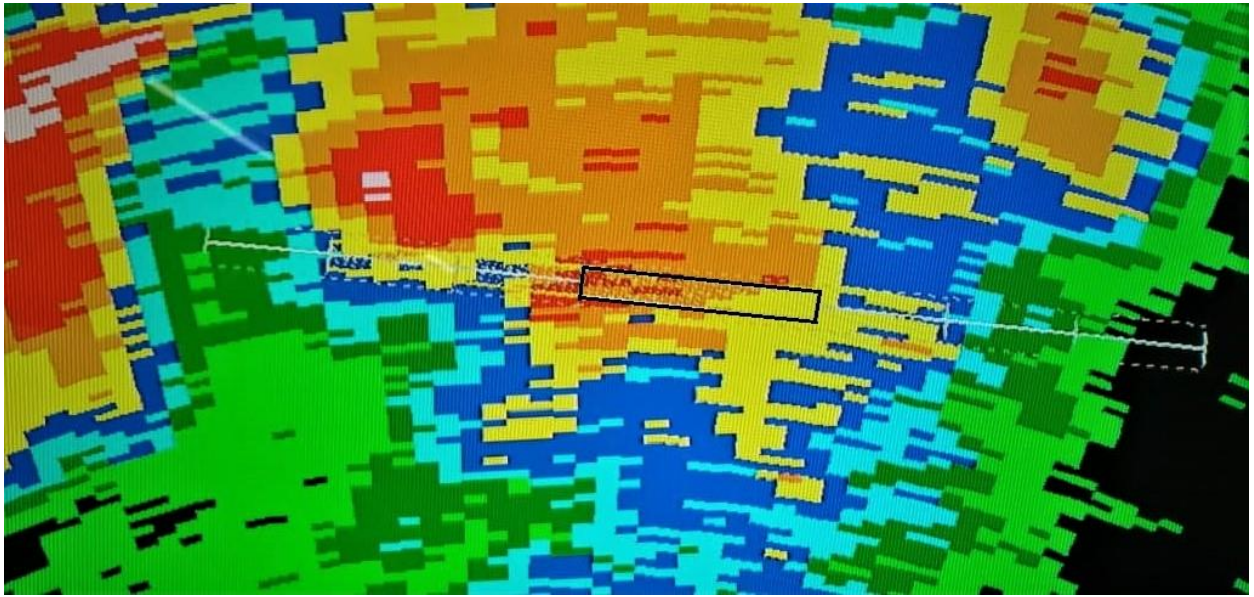


Figure 8: Weather radar display at 10:00 UTC.

Figure 8 shows moderate rain in the touchdown zone of RWY 28 (depicted by the yellow colour in the left-hand part of the rectangle indicating the runway) and heavy rain on the remaining part of the runway (indicated by the orange and red colour).

At 10:05, the landing time of flight TAK 270, the KGL weather radar system displayed the following pattern:



Figure 9: Weather radar display at 10:05 UTC.

Figure 9 shows light rain in the touchdown zone of RWY 28 (depicted by the blue colour in the left-hand part of the rectangle indicating the runway) and moderate to heavy rain on the last part of the runway (indicated by the yellow and orange colour).

The B727 aircraft was equipped with a weather radar system that was serviceable and available to the cockpit crew of flight TAK 270.

1.7.3 KGL windshear warning system

The Meteorological Office of KGL also is equipped with a low level windshear alert system that generates a warning in case of sudden changes in wind direction and/or speed. Such warnings are based on signals of six wind speed sensors located in the vicinity of the airport and are automatically communicated to Approach and Tower Control.

During the approach of the Q400 flight that preceded flight TAK 270, the system generated a warning once. During approach and landing of flight TAK 270 no warnings were triggered.

1.8 Aids to navigation

The crew of flight TAK 270 conducted an ILS approach on runway 28 at KGL. At the time of the incident the ILS was available and serviceable.

The airspace on the route Nairobi - Kigali is classified as RVSM⁹ airspace. The EY-724 B727 aircraft was technically not equipped for flying in RVSM airspace. The Air Operator Certificate, issued by the Civil Aviation Authorities of Tajikistan specifically precludes RVSM operation of the EY-724 aircraft.

However, the Tajik Certificate of Airworthiness indicates in the Tajik language only: Иҷозат дорад, which means 'Allowed'.

⁹ RVSM Airspace: **Reduced vertical separation minima** (RVSM) is the reduction, from 2,000 feet to 1,000 feet, of the standard vertical separation required between aircraft flying between flight level 290 (29,000 ft) and flight level 410 (41,000 ft).

1.10 Aerodrome information¹⁰

Kigali International Airport (KGL) is equipped with one runway (RWY) in the direction 10/28. RWY 28 is used for landing, while RWY 10 is used for take-off.

To this respect the Rwanda Aeronautical Information Publication (AIP) states:

“RWY 10 is not allowed for landing, except with ATC authorisation”.

When checking the runway condition shortly after the incident, it was found that the entire touchdown zone of RWY 28 was covered with a substantial layer of rubber as is illustrated by figure 10 below, indicating how the white centreline marking has been faded by accumulated rubber deposits from tires of landing aircraft.

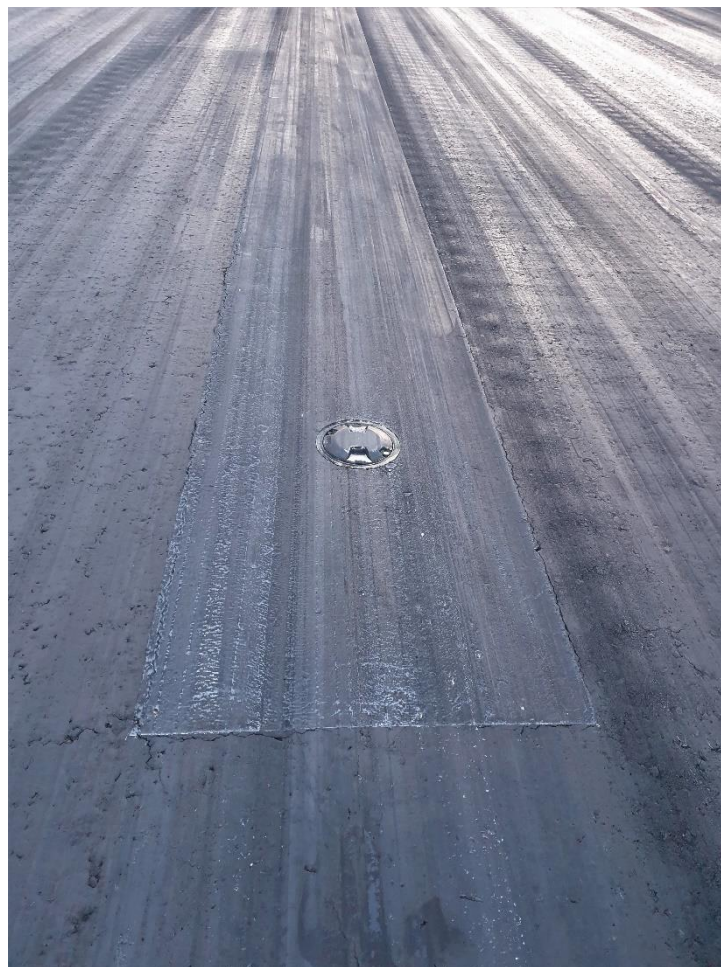


Figure 10: Rubber deposits in touchdown zone of RWY 28.

The Rwanda Airports Company (RAC) informed the AAID that for removal of rubber deposits high-pressure water blast is used where after specialised

¹⁰ This report follows the paragraph numbering according to Appendix 1 of ICAO Annex 13. Paragraphs numbers that are not listed, are not applicable to this investigation.

equipment sucks the deposits from the runway. RAC did not specify at what intervals rubber removal is taking place.

RAC further indicated that runway friction is measured twice a year by means of a ASFT¹¹ T5 trailer that is pulled over the runway by a vehicle at a constant speed of 65 km/hour. According to RAC the following reference values for the friction coefficient are used:

- Design objective for new surface: 0.82
- Maintenance planning level: 0.6
- Minimum friction level: 0.5

The above mentioned information from RAC was supplied by e-mail. Requests from the AAID to consult the KGL Aerodrome Manual were not granted.

Note: *Also during two earlier AAID investigations¹², the RAC Aerodrome Manual was, despite repeated requests, not made available to the AAID.*

1.11 Flight recorders

For this investigation no data from the voice and flight data recorder of the EY-724 aircraft were available.

Zone 4 International, a company based at Entebbe International Airport and holder of the Certificate of Airworthiness for the B727 concerned (see also paragraph 1.17.3), did not maintain a flight data analysis programme for the EY-724 aircraft.

Zone 4 did supply however detailed data from the GPS¹³-based area navigation system with which the aircraft was equipped. These data enabled the AAID to

¹¹ ASFT: Airport Surface Friction Tester

¹² [Report 2018-1](#) on the serious incident to Bombardier CRJ900 with registration 9XR-WH, operated by RwandAir, involving engine damage caused by foreign object debris and:
[Report 2019 1](#) on the serious incident to Airbus A330-300 with registration 9XR-WP, operated by RwandAir, involving an off-runway landing at Kigali International Airport.

¹³ GPS: Global Positioning System

draw up an approximation of the final approach profile and speeds during the landing roll, see paragraph 2.2.2.

Additionally transcripts from the communication between Air Traffic Control and flight TAK 270 were available to the investigation team. These transcripts show that due to insufficient visibility from the Tower because of the heavy rain, the Q400 flight was not transferred to Tower Control but instead received landing clearance from Approach Control.

During final approach of flight TAK 270 the visibility had improved considerably, hence the flight was transferred to Tower Control according to standard procedures.

1.17 Organisational and management information

1.17.1 Aircraft registration

At the time of the runway incursion incident the B727 aircraft carried the Tajik external registration mark EY-724. The identification plate in the cockpit however indicated the Kenyan registration 5Y-CIG, while the operator is listed as Transafrican Air Ltd, see figure 11 below:



Figure 11: Identification plate showing Kenyan registration.

Since Transafrican Air Ltd is a Kenya based company, the Rwanda AAID has, according to ICAO Annex 13 requirements, formally notified the Kenya State Department of Transport as State of the Operator.

Further the Rwanda AAID has repeatedly requested the Kenya State Department of Transport for clarification on the registration discrepancy between the external mark and the identification plate in the cockpit without receiving a response.

1.17.2 Air Operator Certificate

The Air Operator Certificate (AOC) for the B727 aircraft concerned has been issued by the Ministry of Transport of Tajikistan to the operator 'Waypoint Airways' in Dushanbe. During their investigation the Rwanda AAID has found no proof that Waypoint Airways is an active operator. The Civil Aviation Authorities in Tajikistan have not responded to the notification of the runway excursion incident sent by the AAID. Since repeated attempts to get in contact

with the Tajik Authorities were not successful, the AAID requested the ICAO Regional Office in Nairobi for support. The Regional ICAO Officer supplied additional contact addresses in Tajikistan, but after contacting those, the AAID still did not receive a response.

1.17.3 Certificate of Airworthiness

The Certificate of Airworthiness for the B727 aircraft concerned has been issued by the Ministry of Transport of Tajikistan to aircraft holder 'Zone 4 International LLC', a company with a base at Entebbe International Airport, Uganda. On their website 'www.zone4international.com' Zone 4 International listed itself as operator of the B727. The Aircraft Technical Log showed the Zone Four identifier and contact data. However, the flight plan, the flight number TAK 270 and the loadsheet for the incident flight originated from Transafrican Air Ltd.

1.17.4 Certificate of Registration

The Certificate of Registration of the B727 aircraft concerned has been issued by the Ministry of Transport of Tajikistan. The document lists Zone 4 International as owner and Waypoint Airways as holder of the EY-724 aircraft.

The address of Zone 4 International is indicated as U.S.A. ATLANTA, GA.

1.18 Additional information

The Kenya State Department of Transport issued a preliminary report on a ground manoeuvring incident at Jomo Kenyatta International Airport, Nairobi that occurred on Febr. 8th 2018 and concerned the same B727 involved in this investigation.

At the time the aircraft carried the Kenyan registration 5Y-CIG. The Kenya report lists the operator as Transafrican Air. The report further depicts a photo of the B727 showing it in a livery from Lyca Cargo, a company based in Cotonou, Benin. See Appendix 5.2 for the preliminary report from the Kenya State Department of Transport.

2. ANALYSIS

2.1 Introduction

The Analysis is divided in three Parts.

- In Part 1 the possible causal factors for the runway excursion will be assessed, followed by a conclusion on the root cause and main contributing factors that led up to the aircraft drifting from the runway.
- In Part 2 the legitimacy of the certification and operation of flight TAK 270 will be discussed.
- Finally, Part 3 will cover the consequences that the serious incident with flight TAK 270 could have had for the continuation of flight operations at Kigali International Airport.

2.2 Part 1: Possible causal factors for the runway excursion

From the weather reports, communication with ATC and witness statements it can be concluded that flight TAK 270 landed in light to moderate rain with a crosswind component from the right of 11-14 knots and with little or no tailwind. Marks on the runway indicated that the aircraft touched down late, some 420 m beyond the normal touchdown point, and considerably left of the runway centreline, see Appendix 5.1: 'Touchdown point and off-runway trajectory of flight TAK 270'.

The extensive damage to the tailskid mechanism as described in paragraph 1.3.2, in particular the scrape marks on the right-hand aft part of the torn-off tailskid plate found on the runway, show that the aircraft touched down with an unusual high pitch-up and right-roll attitude. The cracked mounting bracket and the uncompressed tailskid cylinder pointing aft are further indications of a high sideways impact force that was exerted to the mechanism during the landing flare.

Factors that might have caused or might have contributed to the subsequent loss of directional control can be summarised as follows:

- **Pilot proficiency**
Pilot proficiency as maintained and checked by a continuous training programme, including yearly proficiency checks on a flight simulator and route checks, like a Line Oriented Safety Audit (LOSA) programme.
- **Rushed and/or unstabilised approach**
Rushed approach: an approach at a too high speed and/or too high descent rate.
Unstabilised approach: an approach that deviates from the normal approach profile.
- **Weather conditions**
Reduced, impaired visibility due to rain.
Prevailing cross- and tailwind, windshear, microburst.
- **Operational aspects**
Late deployment of spoilers/speed brakes; use of braking and reverse thrust before spoilers/speed brakes were deployed.
- **Viscous aquaplaning¹⁴**
Viscous aquaplaning due to the combination of standing water, worn tires and rubber deposits in touchdown zone.
- **Shifting of cargo load**
Cargo pallet(s) breaking loose and moving aft upon touchdown, shifting the centre of gravity on touchdown.
- **Rudder blanking**
Loss or reduction of effectiveness of the rudder (loss of aerodynamic directional control) as a result of a gross disturbance of the airflow upstream of the rudder.
Rudder blanking is a particular risk to aircraft with rear mounted engines and "T" tails, where the activation of thrust reversers deflects air forcefully forwards of the engines to create reverse thrust. The exhaust from the engines, deflected in this way, disrupts the airflow upstream of the rudder.

In the next paragraphs the applicability of the above mentioned factors for the runway excursion of flight TAK 270 will be analysed.

¹⁴ **Viscous aquaplaning** arises in the same way as dynamic aquaplaning, but only on abnormally smooth surfaces such as touchdown zones contaminated with excessive rubber deposits, where it may begin and continue at any ground speed. Typically, a small amount of water may mix with a surface contaminant. A significantly thinner layer of contaminant is required in the event of viscous aquaplaning, compared to that required for dynamic aquaplaning. Viscous aquaplaning leaves no physical evidence on tyre or runway surface.

2.2.1 Pilot proficiency

The cockpit crew of flight TAK 270 was employed by Zone 4 International. However, from paragraphs 1.5.1, 1.5.2 and 1.5.3 it transpired that both the Captain and the F/O were not licensed to conduct flight TAK 270 and that the F/E had not been given any formal training to familiarise himself with the policies and procedures in use by Zone 4 International prior to his first flight in service of this operator.

It must therefore be concluded that Zone 4 International did not meet its responsibilities in scheduling a properly qualified crew and that the proficiency of the Captain and F/O was by no means warranted.

2.2.2 Rushed and/or unstabilised approach

The EY-724 aircraft was equipped with a GPS based navigation system. Data from this system enabled the AAID to assess the final approach path of flight TAK 270. From this assessment it can be concluded that the flight came in at a lower than usual final approach path angle and at a speed that was 10-15 knots too high. The computations of the deviation from the standard approach profile of flight TAK 270 can be found in Appendix 5.3.

The low approach path angle and high final approach speed form a credible explanation for the fact that the aircraft touched down some 420 m beyond the normal touchdown point.

2.2.3 Weather conditions

Although the weather conditions during landing of flight TAK 270 (light to moderate rain, a visibility of 2000 m and 11-14 knots of crosswind from the right) were not ideal, such conditions should not be problematic for a well-trained, proficient crew. This aspect is further illustrated by the fact that the preceding Q400 flight, despite poor visibility values due to heavy rain, landed normally.

No evidence for sudden rain, gusts or a windshear during the touchdown phase of flight TAK 270, as was indicated by the cockpit crew, has been found.

It can therefore be concluded that the actual weather conditions during final approach and landing did not play a decisive role in the runway excursion of flight TAK 270.

2.2.4 Operational aspects

Since no flight recorder data for this investigation were available, the correct deployment of the speed brakes, braking technique, the use of reverse thrust and other relevant flight techniques could not be assessed.

It can be said however that, since the flight came in low and fast (see Appendix 5.3) and was drifting left of the runway centreline, the crew of flight TAK 270 should have initiated a go-around instead of continuing their landing attempt.

The damage pattern to the tailskid mechanism is a clear indication of an incorrect crosswind landing technique, resulting in an unusual high pitch-up and right roll attitude upon touchdown. This attitude will have impaired forward visibility, which is a credible explanation for the statement from both pilots that they suddenly lost visibility during touchdown.

2.2.5 Viscous aquaplaning

Aquaplaning in general and viscous aquaplaning in particular is a dangerous phenomenon that has caused many aviation incidents and accidents over the years.¹⁵

Main gear touchdown on a wet runway should always be firm in order to break through the surface water film, and making effective contact with the runway surface to spin-up the wheels. This is important since a stationary wheel can generate a wall of water in front of it on which the wheel will aquaplane.

However, all three cockpit crewmembers stated that the touchdown was ‘soft’ or ‘smooth’. Additionally the following factors make viscous aquaplaning a very likely factor in the loss of directional control of flight TAK 270:

- The runway was wet due to the heavy rain that prevailed shortly before landing of flight TAK 270; probably there was standing water on the runway since a witness statement indicated that the aircraft ‘did splash the water on the runway upon touchdown’.

¹⁵ As an example: On 7 December 2009, an Embraer 135 being operated by South African Airlink on a domestic passenger flight from Cape Town to George was unable to stop on the wet runway at destination after touchdown in normal day visibility. The flight overran the runway beyond the aerodrome perimeter before coming to rest on a public road.

- The entire touchdown zone of runway 28 was covered by a substantial layer of rubber deposits (also see figure 10 in paragraph 1.10). In combination with a wet runway this forms a well-recognised circumstance for a lack of runway friction.
- The main gear tires of the EY-724 aircraft were all worn to the minimum acceptable limit.
- Deceleration during the landing roll of flight TAK 270 was unusually slow, which is an indication of reduced wheel brake effectiveness. GPS data indicate that the aircraft was still travelling at a groundspeed of 111 knots (205 km/hour) at a position 300 m West of taxiway Charlie, see Figure 12 below:

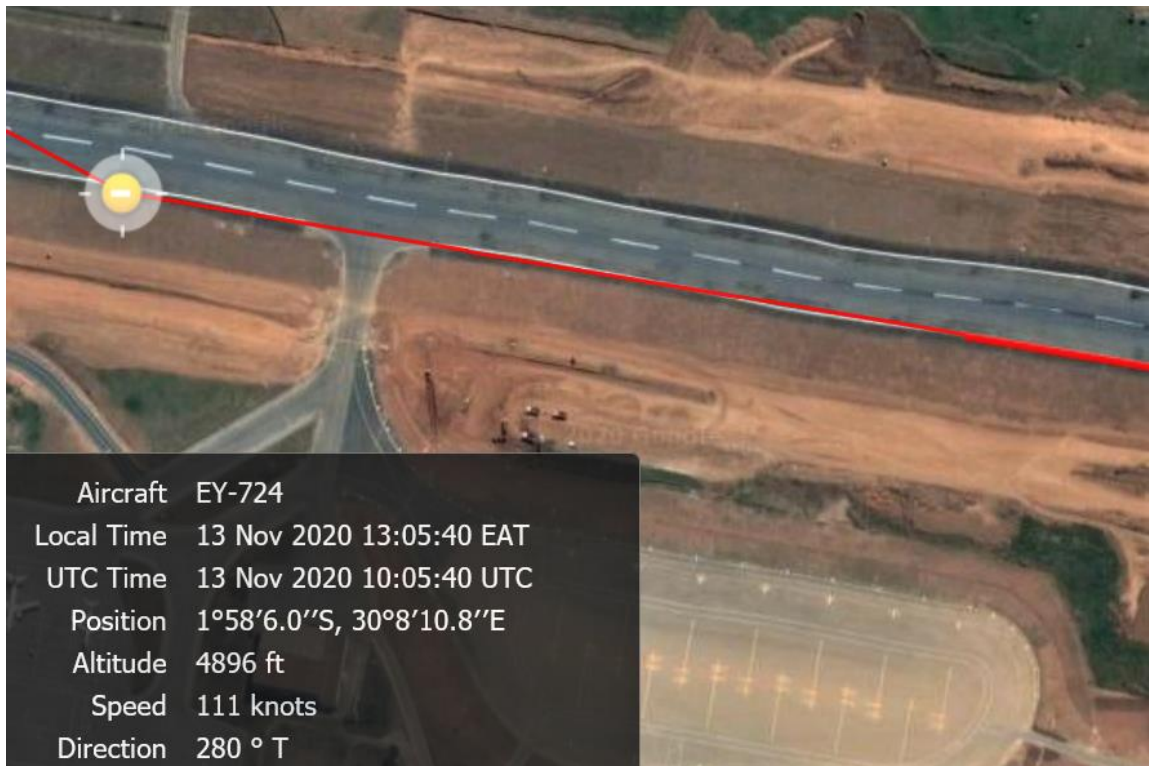


Figure 12: Speed of Flight TAK 270 300 m after passing taxiway Charlie.

2.2.6 Shifting of cargo load

Normally shifting of cargo load would become apparent upon rotation during take-off. Yet, cargo pallets moving aft during the landing flare are a possible explanation for the sudden pitch-up of the aircraft during landing at KGL.

However, shifting of cargo load during the landing phase can be eliminated, since it was confirmed that all cargo pallets were locked prior to unloading of the aircraft at KGL

2.2.7 Rudder blanking

Although it cannot be unambiguously demonstrated that rudder blanking indeed was a factor in the loss of directional control of flight TAK 270, the combination of the high pitch-up attitude, crosswind and the use of reverse thrust make it likely that the effectiveness of the rudder was reduced due to aerodynamic blanking, which impaired directional control during the crucial high speed phase of the initial landing roll.

2.2.8 Conclusive remarks on causal factors for the runway excursion

After weighing all factors from paragraph 2.2.1 through 2.2.7 it can be concluded that the excursion was caused by lack of proficiency of the crew, foremost by not conducting a go-around when the aircraft had drifted to the left on short final approach. The satellite picture 13 below clearly illustrates the significant flight path deviation that should have been reason for initiating a go-around.

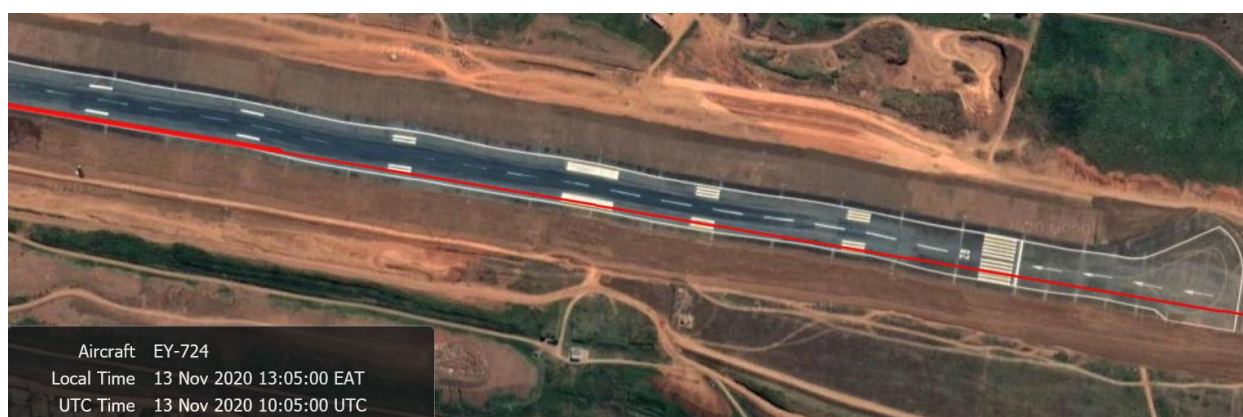


Figure 13: Satellite picture showing the track of flight TAK 270 on short final approach.

After the decision to continue for landing the runway excursion became unavoidable because of an incorrect crosswind landing technique and subsequent skidding due to viscous aquaplaning once the aircraft was on the ground.

2.3 Part 2: Legitimacy of the certification and operation of flight TAK 270

2.3.1 Status of the Air Operator Certificate

An Air Operator Certificate (AOC) is the approval granted from a National Aviation Authority to an aircraft operator to allow it to use aircraft for commercial purposes. This requires the operator to have personnel, assets and systems in place to ensure the safety of its employees and the general public.

With regard to the EY-724 aircraft it was the Ministry of Transport of Tajikistan that issued the AOC to the operator ‘Waypoint Airways’ in Dushanbe. Based on the information from paragraph 1.17.2, the AAID has reason to believe that ‘Waypoint Airways’ is not an active aircraft operator and does not fulfil the requirements that apply for an AOC holder. It must therefore be concluded that the AOC for the EY-724 aircraft has been issued unlawfully.

2.3.2 Discrepancy of the aircraft registration marks

Article 18 of the Convention on International Civil Aviation, commonly known as the ‘Chicago Convention’, states that: “An aircraft cannot be validly registered in more than one State, but its registration may be changed from one State to another.”

Further, Article 9.1 of Annex 7 to the Chicago Convention¹⁶ states that: “An aircraft shall carry an identification plate inscribed with at least its nationality or common mark and registration mark.”

As pointed out in paragraph 1.17.1 the Boeing B727 involved in the runway excursion at KGL carried the Tajik external registration mark EY-724. The identification plate in the cockpit however indicated the Kenyan registration 5Y-CIG. This discrepancy can mean the following:

¹⁶ ICAO Annex 7: AIRCRAFT NATIONALITY AND REGISTRATION MARKS.

1. The aircraft has been registered in Tajikistan and deregistered in Kenya, whereby replacing the identification plate in the cockpit has been omitted. That would be a violation of Article 9.1 of Annex 7 by the Tajik Authorities.
2. The aircraft has been registered in Tajikistan, but not formally deregistered in Kenya. That would be a violation of Article 18 of the Chicago Convention by the Kenyan Authorities.

In order to clarify this matter, the AAID has repeatedly tried to contact both the Tajik and Kenyan Authorities but did not receive a response. It can be concluded however that operating an aircraft with a discrepancy between the external registration mark and the identification plate in the cockpit is a violation of ICAO Standards.

2.3.3 Ambiguity about the operator of flight TAK 270

While it is possible that an aircraft operator differs from the holder of the Air Operators Certificate, it is laid down that there can only be one party who owns an aircraft or has obtained such aircraft for flight operation purposes.

Zone 4 International LLC is mentioned as owner of the EY-724 aircraft on the Certificate of Registration, had hired the crew for flight TAK 270 and lists itself on their website as operator. Based on these facts, Zone 4 International LLC should be considered as the operator.

The identification plate in the cockpit however indicates Transafrican Air Ltd as the operator. Also the header of the flightplan states that Transafrican is the operator for flight TAK 270, see the figure 14 below. Based on these facts, Transafrican Air Ltd should be considered as the operator.

KCAA **FPL Report**
efficiently managing air safety
 JOMO KENYATTA INTERNATIONAL AIRPORT, AVIATION HOUSE, NAIROBI
 TEL: +254 020 6827470-75 MOBILE: +254709725000 MOBILE: +254726613406 Fax: +254 020 6822 300
 Email: aim@kcaa.or.ke

| | |
|--------------------|---------------------|
| Report created by: | k184fd |
| Report created on: | 2020-11-13 05:05:22 |

ID: 444111

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(FPL-TAK270-IS
-B727/M-SDFGIHYWXZR/EB1
-HKJK0600
-N0450F360 NAVEX GENIK UL442 APLOG DCT
-HRYR0100 HUEN HBBA
-PBN/A1B1 NAV/SBAS DOF/201113 REG/EY724 EET/HTDC0020 HRYR0050
OPR/TRANSAFRICAN AIR RMK/CGON FLT)
```

| | |
|--------------------------|-----------------------------|
| Id: | 444111 |
| Callsign: | TAK270 |
| Version: | 1 |
| Pre Distribution Status: | PENDING |
| Departure Ad: | HKJK |
| Destination Ad: | HRYR |
| Route: | NAVEX GENIK UL442 APLOG DCT |

Figure 14: Flightplan showing Transafrican Air is the operator for flight TAK 270.

It can thus be concluded that it is not clear whether Zone 4 International or Transafrican Air is to be considered as the operator of flight TAK 270. Such ambiguity is not in conformity with ICAO Standards and precludes a clear assignment of responsibilities between the State of Registry (Tajikistan) and the State of the Operator (either Uganda or Kenya) as described in Article 83 Bis of the Chicago Convention¹⁷, thereby rendering effective safety oversight impossible.

¹⁷ Article 83 Bis of the Chicago Convention provides for the transfer of certain functions and duties from the State of Registry to the State of the Operator.

2.3.4 Importance of the investigation structure laid down in ICAO Annex 13

In ICAO Annex 13¹⁸ it is laid down that the State in whose territory an accident or serious incident with a civil aircraft has occurred shall notify, amongst other parties, the State of the Operator and the State of Registration. Annex 13 further details the way the State of the Operator and the State of Registration shall cooperate with the State of Occurrence during the conduct of the investigation. This cooperation may include the assignment of an accredited representative from the State of the Operator and the State of Registration who participates in the investigation team of the State of Occurrence.

The structure as laid down in Annex 13 warrants the conduct of an effective investigation, resulting in well-balanced safety lessons to be drawn and has proven to be an invaluable element in attaining the current high safety standards of the global civil aviation sector.

Therefore, by not responding to the notification of the B727 runway excursion sent by the Rwanda AAID, both the Tajik and Kenyan Investigation Authorities not only breached ICAO standards, but also impeded the drawing of essential safety lessons.

2.3.5 Crew qualification and flight operational aspects

The paragraphs 1.5.1 and 1.5.2 indicate that the Congolese licenses of the Captain and the First Officer were non-existent, respectively suspended. It must therefore be concluded that the converted licenses issued by the Tajik Ministry of Transport were given out on incorrect grounds and that the Tajik Civil Aviation Authorities failed to adequately check the credentials of both pilots of flight TAK 270.

Further, Zone 4 International did not fulfil its responsibility to properly check the validity of the licenses of the pilots they had hired for the conduct of flight TAK 270.

As indicated in paragraph 1.8 the B727 involved in the runway excursion incident was technically not equipped for operation in airspace where reduced vertical separation minima (RVSM) apply. However, with regard to RVSM

¹⁸ ICAO Annex 13: AIRCRAFT ACCIDENT AND INCIDENT INVESTIGATION

operation the Tajik Certificate of Airworthiness indicated in the Tajik language only: Иҷозат дорад, which means ‘Allowed’.

Based on the above it must be concluded that the apparent permission for RVSM operation on the Tajik Certificate of Airworthiness was not justified by the status of the aircraft equipment.

The routing between NBO and KGL falls within RVSM airspace, implicating that non-RVSM aircraft can only fly below FL 290 or above FL 410. However, the cruise portion of flight TAK 270 was conducted at FL 370.

Although the missing RVSM approval is not directly related to runway excursion incident, it must therefore be concluded that the flight violated the RVSM operating regulations.

ICAO Annex 6¹⁹ requires an operator of an aeroplane with a maximum take-off mass in excess of 27 000 kg to establish and maintain a flight data analysis programme as part of its safety management system.

Since for the B727 involved in the runway excursion incident no such flight data analysis programme was available, it must be concluded that the operator of the EY-724 aircraft did not comply with this ICAO standard.

2.4 Part 3: Potential risks for the operation of Kigali Airport

From the GPS groundspeed data supplied by Zone 4 International it can be deduced that flight TAK 270 passed taxiway Charlie at a speed between 210 and 215 km/hour with an aircraft mass of 139.400 pounds or 63.230 kilograms. The kinetic energy resulting from these figures could easily have resulted in a crash of the aircraft, in particular at the moment whereby the left-hand landing gear, while travelling through the soft grass area next to the runway, hit the side of taxiway Charlie as is illustrated by the red arrow on picture 15 below.

¹⁹ ICAO Annex 6: OPERATION OF AIRCRAFT, paragraph 3.3.2



Figure 15: Impact point of left-hand landing gear with the side of taxiway Charlie.

It also must be noted that the lateral distance between the track of the left-hand nose gear wheel and the edge of the runway shoulder was approximately one metre only. Should the nose gear during the high speed phase of the landing roll have left the pavement of the shoulder, then a crash of the aircraft would have been unavoidable.

Such a crash would have rendered the only runway of Kigali International Airport inoperative until removal of the aircraft and debris from the runway and its surrounding strip area²⁰.

It may therefore be concluded that allowing flights from operators that do not fulfil the required basic safety and quality standards not only pose a safety risk to persons and livestock, but also may have serious logistic and economic consequences.

²⁰ The 'runway strip' is defined as an area of prescribed dimensions surrounding the runway that is prepared or suitable for reducing damage to aircraft in the event of unintentional excursion from the runway surface.

3. CONCLUSIONS

3.1 Findings

3.1.1 Flight TAK 270 from Nairobi to Kigali on Nov. 13th 2020 was conducted unlawfully since:

- Both the Captain and the First Officer had no valid license;
- The Air Operator Certificate under which the aircraft was operating had been issued by the Tajik Ministry of Transport to ‘Waypoint Airways’, a non-active aircraft operator that does not fulfil the requirements for being an AOC holder.

3.1.2 Ambiguity exists about the question whether Zone 4 International (with a base in Entebbe, Uganda) or Transafrican Air (based in Nairobi, Kenya) is to be considered as the operator of flight TAK 270.

3.1.3 The combination of an illegitimate AOC holder in Tajikistan and ambiguity about the party to be considered as the operator of flight TAK 270 (Zone 4 International in Entebbe, Uganda or Transafrican Air in Nairobi, Kenya) precludes effective safety oversight from the Civil Aviation Authorities involved.

3.1.4 The B727 aircraft involved in the runway excursion at Kigali International Airport carried the external Tajik registration mark EY-724, while the identification plate in the cockpit indicated the Kenyan registration 5Y-CIG.

3.1.5 The Civil Aviation Authorities in Tajikistan and Kenya did not respond to the notification of the serious incident with the B727 involved sent by the AAID, nor did they respond to ensuing requests for additional information.

- 3.1.6 Flight TAK 270 from Nairobi to Kigali was conducted on a flight level that was allocated for Restricted Vertical Separation Minima (RVSM) operations, while the B727 involved in the runway excursion incident was neither technically equipped nor certified for flying in RVSM airspace.
- 3.1.7 The final approach of flight TAK 270 to runway 28 of Kigali International Airport was not stabilised since:
- The final approach speed was 10 to 15 knots too high;
 - The actual approach angle was approximately 0.5 degrees below the standard 3.0 degree glide path;
 - The aircraft drifted significantly left of centreline during the final stage of the approach;
 - The aircraft touched down approximately 420 m beyond the normal touchdown point.
- 3.1.8 Despite the unstable final approach, the crew of flight TAK 270 did not perform a go-around.
- 3.1.9 Although the weather conditions during landing of flight TAK 270 (light to moderate rain, a visibility of 2000 m and 11-14 knots of crosswind) were not ideal, these conditions would not have precluded a safe landing by a well-trained, proficient crew.
- 3.1.10 During landing of flight TAK 270 the runway was wet due to rain.
- 3.1.11 The touchdown zone of runway 28 was covered by a layer of rubber deposits after rain.
- 3.1.12 The Rwanda Airports Company should implement procedures for removal of rubber deposits and the conduct of runway friction tests.
- 3.1.13 During touchdown the tailskid mechanism of the aircraft was heavily damaged.

- 3.1.14 The damage pattern of the tailskid mechanism indicated that the aircraft touched down at an unusual high pitch-up and right roll attitude.
- 3.1.15 After touchdown flight TAK 270 lost directional control, and travelled outside the runway over a total distance of 1005 m.
- 3.1.16 The left-hand main gear travelled over the grass area next to the pavement of the runway shoulder over a distance of 577 m.
- 3.1.17 During the runway excursion of flight TAK 270 15 runway edge lights were shattered, resulting in damage to all tires of the aircraft.
- 3.1.18 During the runway excursion flight TAK 270 reached taxiway Charlie:
- With the left-hand main gear travelling through the grass;
 - With the nose gear travelling at a lateral distance of one metre from the edge of the runway shoulder pavement;
 - At a speed between 210 and 215 km/hour.
- These conditions presented a considerable risk for a crash of flight TAK 270.

3.2 Causal factors

3.2.1 The crew not conducting a go-around when the aircraft had drifted to the left of the centreline on short final approach.

3.2.2 Lack of proficiency of the Captain and First Officer resulting from:

- Them carrying no valid licenses for the operation of the B727;
- non-adherence to basic safety and quality standards by the operator Zone 4 International LLC and
- deficient oversight from the Civil Aviation Authorities in Tajikistan, Uganda and Kenya.

3.3 Contributory factors

After the decision to continue for landing the runway excursion became unavoidable because of:

- an incorrect crosswind landing technique and
- subsequent skidding due to viscous aquaplaning once the aircraft was on the ground.

4. SAFETY RECOMMENDATIONS

To Rwanda:

- 4.1 The Rwanda Civil Aviation Authority (RCAA) and the Rwanda Airports Company (RAC) are recommended to develop and implement a proactive method to assess the legitimacy of operators and their adherence to basic safety standards before allowing them to dispatch flights to destinations in Rwanda.
- 4.2 The Rwanda Airports Company (RAC) is recommended to conduct regular rubber removal and have periodic friction tests for runway 10/28 at Kigali International Airport (KGL).

To Foreign States:

- 4.3 In order to warrant effective drawing of safety lessons, the Investigation Authorities of Tajikistan and Kenya are recommended to ensure proper response to incident and accident notifications by the State of Occurrence as laid down in ICAO Annex 13.
- 4.4 In case an operator under their authority operates an aircraft that is listed on a foreign Air Operator Certificate, the Civil Aviation Authorities of Kenya and Uganda are recommended to verify the legitimacy of that AOC.

To Foreign States (continued):

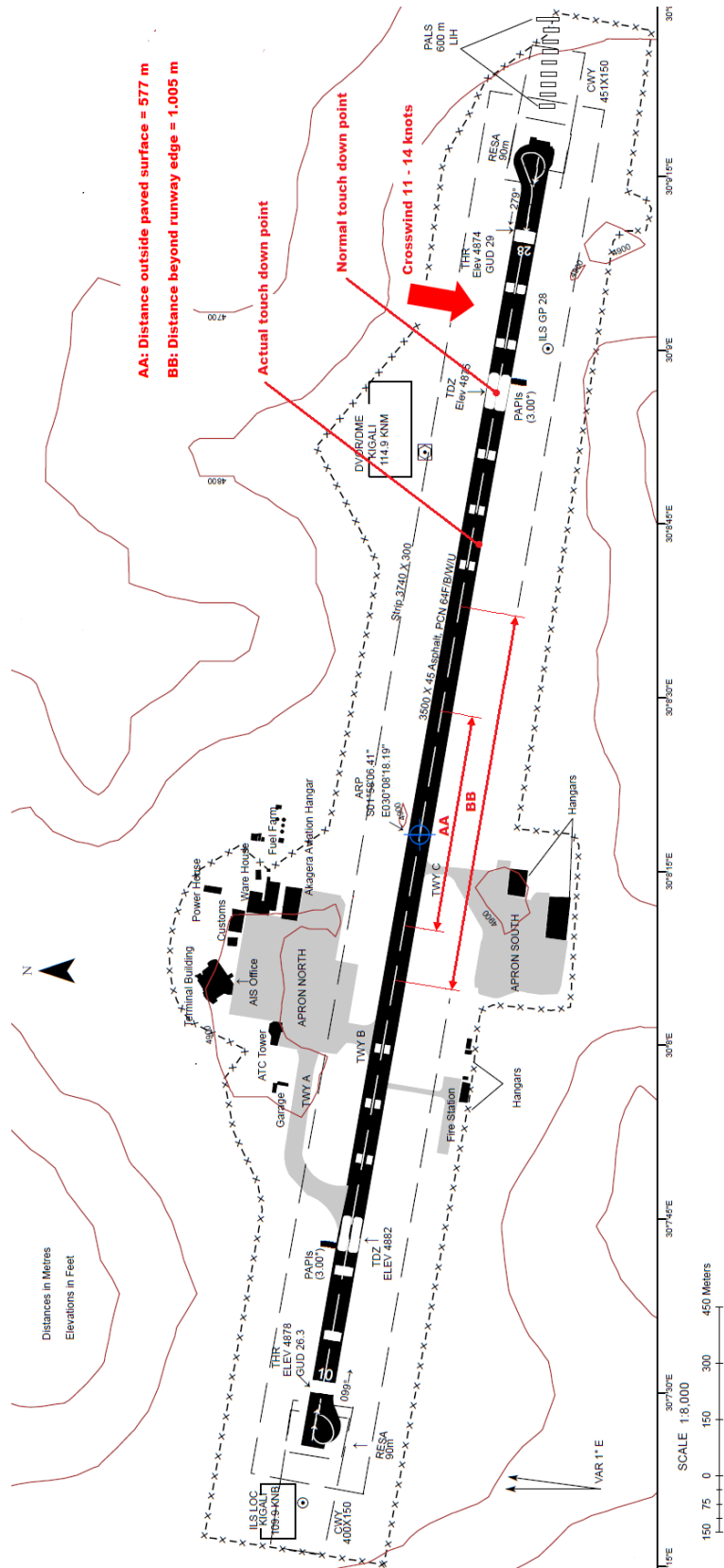
- 4.5 In case an operator under their authority operates an aircraft under the registration of a foreign State, the Civil Aviation Authorities of Kenya and Uganda are recommended to establish an agreement that regulates the oversight responsibilities between the State of the Operator and the State of Registration in accordance with Article 83 Bis of the Chicago Convention.
- 4.6 The Civil Aviation Authorities of Tajikistan and Kenya are recommended to resolve the discrepancy between the external Tajik registration mark EY-724 and the Kenyan registration 5Y-CIG on the identification plate in the cockpit of the B727 with MSN²¹ 19011.
- 4.7 The Civil Aviation Authorities of Kenya and Uganda are recommended to resolve the ambiguity about the question whether Zone 4 International (with a base in Entebbe, Uganda) or Transafrican Air (based in Nairobi, Kenya) is to be considered as the operator of the B727 with MSN 19011.

²¹ MSN: Manufacturer's Serial Number

5. APPENDICES

Appendix 5.1:

Touchdown point and off-runway trajectory of flight TAK 270



Appendix 5.2:

Preliminary report from Kenya State Department of Transport



MINISTRY OF TRANSPORT, INFRASTRUCTURE, HOUSING AND URBAN DEVELOPMENT

STATE DEPARTMENT OF TRANSPORT

AIRCRAFT ACCIDENT INVESTIGATIONS

PRELIMINARY REPORT

| | |
|------------------------------|---|
| OPERATOR: | TRANSAFRICAN AIR LTD |
| AIRCRAFT TYPE/ MANUFACTURER: | B727-30C, THE BOEING COMPANY |
| YEAR OF MANUFACTURE: | 3 MARCH 1967 |
| AIRCRAFT REGISTRATION: | 5Y-CIG |
| AIRCRAFT SERIAL NUMBER: | 19011 |
| DATE OF REGISTRATION: | 1 DECEMBER 2017 |
| TYPE OF ENGINE: | 3 x PRATT AND WHITNEY JT8D |
| DATE OF OCCURRENCE: | 8 FEBRUARY 2018 |
| TIME OF OCCURRENCE: | 1838 |
| LOCATION OF OCCURRENCE: | JOMO KENYATTA INTERNATIONAL AIRPORT (HKJK) |
| TYPE OF FLIGHT: | FERRY FLIGHT |
| NUMBER OF PERSONS ON BOARD: | FIVE (5) |
| INJURIES: | NIL |
| NATURE OF DAMAGE: | NIL |
| CATEGORY OF OCCURRENCE: | INCIDENT |
| PIC'S FLYING EXPERIENCE: | 12,000 HRS (TOTAL) |

All times given in this report is local.

East African Local Time is UTC plus (+) 3 hours.

PHOTOS



The two aircraft that were involved in the incident.

NARRATIVE

On 8 February 2018, a Boeing 727-300 aircraft, registration 5Y-CIG operated by Transafrican Air performing a ferry flight from Fujairah International airport (OMFJ), United Arab Emirates (UAE) to the Jomo Kenyatta International airport was involved in a ground incident.

It was reported that after landing at about 1838 on runway 06, the aircraft vacated the runway into taxiway G and then switched to ground frequency. The captain requested clearance for parking at bay J but due to airport congestion, he was advised to further preceded to Apron 2 which had been reserved. This was done with the guidance of a lead service vehicle. As they approached this parking bay the captain reported that he was uncertain as to whether the marshaller had clear visibility of the wing tips and stopped the aircraft. He observed the marshaller stood with his arms out and thumbs up to indicate aircraft 5Y-CIG was clear of obstacles, particularly the vertical stabilizer of the Fokker 50 registration 5Y-WFB parked on the right side of the taxing aircraft. The captain resumed taxing towards the final point. However the right outboard leading edge wing of 5Y-CIG came into contact with the vertical stabilizer of aircraft 5Y-WFB.

Both aircraft sustained minor damage and no one was injured.

SAFETY RECOMMENDATION

This incident highlights the importance of aircraft operators conducting a thorough risk assessment where ground movement space is confined, particularly movements involving congested parking bays and parking of aircraft in non-designated bays.

Fredrick Kabunge

Investigator -In-Charge

20-February-2018

Appendix 5.3:

Analysis of glide path and final approach speed of flight TAK 270

A. Assessment of glide path angle

The GPS plots received from Zone Four International include this position on short final, see figure A:



Figure A

When calculating the distance between this position and the touchdown point for the ILS of runway 28 KGL, we find a distance of 2.477 m, see figure B below:

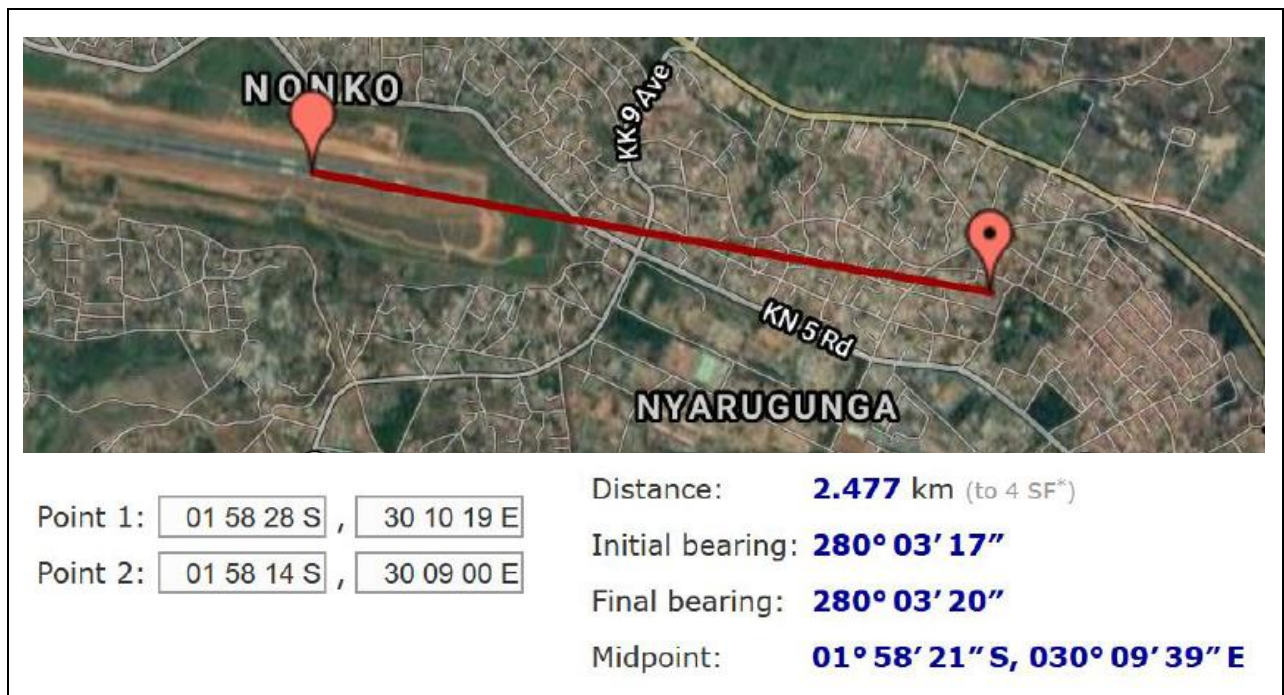


Figure B

The GPS altitude of the aircraft when at the position listed in figure 1 was 5.253 ft. The elevation of the touchdown zone of runway 28 KGL is 4.875 ft. When at the position of figure A, flight TAK 270 therefore was 378 ft or 115 m above the touchdown zone as illustrated in figure C:

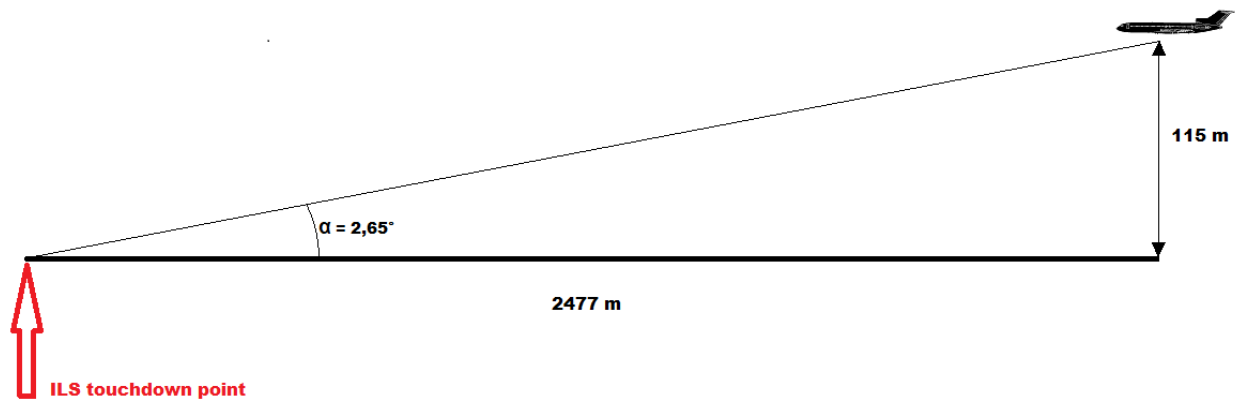


Figure C

As illustrated above, the resulting glide path angle is 2,65°, which is lower than the standard ILS glide slope angle of 3°.

B. Reliability of GPS position, groundspeed and altitude data

While GPS position and GPS groundspeed data can be considered as sufficiently precise for analysis of the final approach speed of flight TAK 270, GPS altitude measurement is less accurate than its horizontal position measurement. To that respect it is noteworthy that, when parked at stand 6 of Apron North of KGL International Airport, the GPS altitude of the EY-724 aircraft indicated an average value of 4912 ft. Since the Aeronautical Information Publication (AIP) of Rwanda lists that the actual elevation of stand 6 is 1490,8 m, equalling 4891 ft, it can be concluded that the GPS altitude indication on the ground was some 21 ft too high. When we apply that correction to the altitude of the GPS datapoint from figure A, then the altitude would be (5253 - 21 =) 5232 ft. When taking this corrected altitude into account, the glide path angle of flight TAK 270 as depicted in figure 3 would then change from 2,65° to 2,53°.

The applied altitude correction therefore further confirms the conclusion that during its final approach phase flight TAK 270 was considerably below its standard 3° glide path.

C. Assessment of final approach speed

At the position shown in Figure A the ground speed of flight TAK 270 was 178 knots. The METAR from 09:30 UTC listed a wind of 140/08, which means a tailwind of 6 knots. The METAR from 10:00 UTC listed a wind of 040/13, which means a tailwind of 7 knots. The latest wind given by Tower Control to the crew was 020/11, which means a tailwind of 2 knots.

When taking into account an average tailwind component of 5 knots for the final phase of the approach, the True Air Speed (TAS) would then have been (178 - 5 =) 173 knots.

A TAS of 173 knots at an altitude above Mean Sea Level (MSL) of 5,253 ft and an off-standard temperature component of +15°C results in an indicated airspeed (IAS) of 156 knots.

At a landing weight according to the loadsheet of 139,400 lbs, the reference speed (Vref)²² for a flaps 30 landing on the B727-100 is 127 knots IAS. Boeing recommends a 10 knots increment to Vref. In extremely gusty winds a wind correction factor of 20 knots is the advised maximum. During final approach of flight TAK 270 winds were more or less steady from the North East, not exceeding 13 knots with CB's in the direct vicinity. When taking into account a wind correction factor of 15 knots under the prevailing conditions, the Final Approach Speed would be (127 + 15 =) 142 knots. With the actual IAS being 156 knots at 378 ft on short final less than one minute before touch down, it may be concluded that the actual FAS was some 10 - 15 knots higher than advised.

Summary

During the final stage of the approach flight TAK 270 came in considerably below the standard glide path of the ILS for runway 28 at a speed that was 10 - 15 knots higher than advised.

²² Vref equals 1.3 times the stalling speed in the landing configuration and at the prevailing aircraft weight.