

Ref. No. CZ-13-193

FINAL REPORT
Investigation into the incident of aircraft type Fokker F100,
registration mark OE-IIB, at LKKU aerodrome
on 3rd June 2013

Prague
February 2014

This investigation has been carried out in accordance with the Regulation EU No 996/2010, Act No 49/1997 Coll., on civil aviation and Annex 13 to the ICAO Convention on International Civil Aviation. The sole objective of the investigation of an accident or incident under these Regulations shall be the prevention of accidents and incidents. It shall not be the purpose of such an investigation to apportion blame or liability.

The Final Report, findings and conclusions therein concerning air accidents and incidents, and possibly systemic shortcomings endangering operational safety, are only of an informative nature and cannot be used otherwise than as a recommendation for the implementation of measures in order to prevent further air accidents and incidents with similar causes. The creator of the Final Report explicitly states that the Final Report cannot be used to determine blame or responsibility in connection with determining the causes of an air accident or incident and cannot be used for enforcing claims in the event of an insurance claim.

Abbreviations used

ATPL	Pilot licence
GSPD	Ground speed
FI	Pilot classification
LKKU	Aerodrome Kunovice
MAGHDG	Magnetic heading
p/n	Part number
PAX	Passenger
RADALT	Radio attitude
RWY	Runway
TWR	Tower LKKU
TWY	Taxiway
UTC	Coordinated Universal Time
AAIL	Air Accident Investigation Institute of the Czech Republic

Units

FH	Flight hours
Ft	Feets
lb	Pounds
kt	Knots (airspeed unit – 1.852 km.h ⁻¹)
min	Minute
m	Metre
sec	Second
MHz	Megahertz

A. Introduction

Owner/Operator :	M-Jet Aviation, Austria
Manufacturer and aircraft model:	Fokker, typ F28.Mk100, model F100
Registration mark	OE-IIB
Site	LKKU
Date and time	3 rd June 2013, 13:10 UTC (all times are UTC)

B. Synopsis

On 3rd June 2013 the AAI was notified by telephone of an incident of aircraft Fokker F100 by the operator of the Kunovice Airport. After landing and taxiing the end of the runway, the aircraft stopped and wanted to make a U-turn. While the aircraft was turning to the right, the front and later also both main wheels ran out the runway and the aircraft stopped at the right side of RWY 21C. During that time neither passengers nor the crew were injured. The steering mechanism of front wheels was damaged. The event was classified as an incident.

The event investigated by inspector AAI - Ing. Lubomír Stříhavka.

The final report was issued by:

Air Accident Investigation Institute
Beranových 130
199 01 Praha 99
Czech Republic

On 25th February 2014

The report includes the following main parts:

- 1) Factual information
- 2) Analysis
- 3) Conclusions
- 4) Safety recommendation
- 5) Appendixes

1 Factual information

1.1 History of the Flight

The history of the flight focused on the description of the approaching, landing and taxiing phases. It comprised of the statement of the aircraft pilot, the flight recorder reading and the communication between the crew and LKKU TWR.

1.1.1 Circumstances Preceding the Incident

On 3rd June 2013 a charter flight was carried out by M-Jet Aviation with foreign nationals as clients from the Moscow-Vnukovo airport to Kunovice airport. There were five passengers and the crew present on board. The landing to LKKU was planned for 13:00.

1.1.1 The Event Flight

The course of the final phase of landing and ground movements has been described according to the communication between the pilot and LKKU TWR and completed with the selected data recordings from the aircraft recorder.

At 12:58:31 the pilot received information about the landing conditions from LKKU TWR. The pilot confirmed the mentioned information and after touchdown at 13:01:07, he received an instruction to backtrack and clear RWY. According to the instruction issued the pilot was supposed to turn the aircraft by 180 degrees and taxi via TWY A to the apron.

At 13:02:49 the pilot enquired whether there was any ground aid for Fokker 100 available at the airport.

At 13:03:00 he received a reply from TWR that they would check and enquired the pilot whether he was in need of any special assistance at the turning. At this point, the pilot did not require any assistance.

At 13:03:41 the pilot received information from TWR that there was no ground aid for Fokker 100 available. The pilot confirmed the said information and notified that he would need assistance.

At 13:06:02 the pilot received information from TWR that the assistance was on the way and that they would attempt to assist him with the turn.

At 13:06:15 the pilot replied he needed an aircraft truck.

At 13:06:38 TWR required the specification of the situation from the pilot. The pilot immediately replied that *"they were in the grass with their front wheels"*.

The operator of the service vehicle that had meanwhile reached the stopped aircraft informed TWR about the situation and confirmed that the aircraft had run off the runway into the grass.

Selected data from the recording of the aircraft recording device:

12:58:32: GSPD 134 kt, MAGHDG 209,6°, RADALT 1 325 ft;

13:01:07: GSPD 18 kt, MAGHDG 203,6°, RADALT -3 ft;

13:02:47: GSPD 12 kt, MAGHDG 203,7°, RADALT -3 ft;

13:02:59: GSPD 9 kt, MAGHDG 188,4°, RADALT -2 ft;

13:03:39: GSPD 2 kt, MAGHDG 293,2°, RADALT -2 ft;

13:03:47: GSPD 2 kt, MAGHDG 295,1°, RADALT -2 ft;

13:06:03: GSPD 2 kt, MAGHDG 296,5°, RADALT -3 ft;

13:06:15: GSPD 2 kt, MAGHDG 296,5°, RADALT -3 ft;

The aircraft landed at 13:00:23, GSPD 123 kt, direction 205,7 degrees.

The pilot described the landing as normal in his statement. He noted that he had taxied to the end of the runway and there attempted turning by 180 degrees. Whilst doing so, the front wheels out off the concrete surface of the end of the runway into the grass area. He did not comment on the positioning and aircraft U-turn attempts.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others (inhabitants, etc)
Fatal	0	0	0
Serious	0	0	0
Light/no injury	0/2	0/5	0

1.3 Damage to aircraft

During the check after the event damage to the steering mechanism of (p/n 200429305) was disclosed. The defect was removed by replacing the damaged part with a new one.

1.4 Other damage

There was no other damage on the incident site.

1.5 Personnel information

1.5.1 Captain - personal data:

- man, aged 34 y.
- holder of ATPL (A), FI (A)
- valid medical 1st class/VDL
- nationality - Spain

Flight experience:

- Total on all types 3 670 FH
- Total on type F100 2 200 FH
- As the PIC all types 1 250 FH
- As the PIC on F100 150 FH
- In the last 12 month 195 FH
- In the last 90 days 56 FH
- In the last 30 days 16 FH
- In the last 24 hours 4:20 FH
- The last examination test F100 passed on 15.2.2013.

The pilot started the flying day with a preflight preparation, the service time was 9 hours and 40 minutes. As he has stated, he had a period of rest before the flight in duration of 13 hours.

1.6 Aircraft information

1.6.1 General Specifications of the Aircraft

The Fokker F100 aircraft is a passenger twin engine all-metal airliner with a tricycle retractable landing gear in nose configuration. The aircraft had the maximum take-off mass of 44,450 kg recorded.

Type:	F28.Mk100, model F100
Registration mark:	OE-IIB
Manufacturer:	Fokker
Year of manufacture:	1992
Serial number (s/n):	11403
Airworthiness certificate:	valid
Total flight time	30 653 FH/20 014 cy
Insurance policy:	valid

1.6.2 Aircraft Operation

The last maintenance check was performed on the aircraft on 16nd May 2013. The amount of fuel in the tanks after the landing was 12,000 lb.

1.6.3 Technical Inspection of the Aircraft after the Incident

After the incident, the aircraft was checked by the technical personnel of the operator with the aim to evaluate its technical condition and to verify whether the incident had not been caused by a technical defect and/or malfunction. The damage to the steering mechanism found after the incident was caused in direct effect of the increased rolling resistance force on the front landing gear wheels. The mechanism was damaged due to impressions and partial chipping of teeth in the position that corresponds to the limit position for the right turn.

The damaged parts of the aircraft were replaced on site and the the aircraft was permitted to make a technical overflight to Vienna by the technical personnel of the operator.

1.7 Meteorological Information

According to the report presented by the Aeronautical Meteorological Service of the Czech Hydrometeorological Institute a ridge of low pressure was impacting the Czech Republic from the West. According to the statement of the airport staff the meteorological situation at the LKKU airport was suitable for landing of an aircraft of the given type. The runway visual range was good in all the directions. At the time of landing the pilot received information about the wind direction and force and the state of the runway. Surface wind: 230 degrees, 8 kt, runway is wet.

1.8 Aids to navigation

NIL

1.9 Communications

The LKKU ATS stand was active of radio-communication between the crew and TWR on frequency 120,100 MHz.

1.10 Aerodrome information

LKKU is a no-public international aerodrome. Fitted RWY 03C/21C, 03R/21L, 03L/21R. Runway physical characteristic published on AIP (followed):

LKKU AD 2.12 FYZIKÁLNÍ VLASTNOSTI VZLETOVÝCH A PŘÍSTÁVACÍCH DRAH					
LKKU AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS					
Označení Designations RWY NR	Zeměpisný a magnetický směr TRUE & MAG BRG	Rozměry RWY Dimensions of RWY (m)	Únosnost (PCN) a povrch RWY a SWY Strength (PCN) and surface of RWY and SWY	Zeměpisné souřadnice THR Výška elipsoidu THR coordinates Geoid undulation	THR ELEV a nejvyšší ELEV TDZ RWY pro přesné přiblížení THR elevation and highest elevation of TDZ of precision APP RWY
1	2	3	4	5	6
03C	025°GEO 023°MAG	2000x30	PCN 33/R/B/X/T beton/concrete	49 01 16,62 N 017 26 02,36 E 143 ft/43,5 m	574 ft/175 m
21C	205°GEO 203°MAG			49 02 15,11 N 017 26 44,57 E 143 ft/43,5 m	581 ft/177 m
03R	025°GEO 023°MAG	1690x60	25000 KG (0,70 MPa) tráva/grass	-	571 ft/174 m
21L	205°GEO 203°MAG			-	581 ft/177 m
03L	025°GEO 023°MAG	1480x80	25000 KG (0,70 MPa) tráva/grass	-	571 ft/174 m
21R	205°GEO 203°MAG			-	581 ft/177 m
Sklon RWY-SWY Slope of RWY-SWY	Rozměry SWY SWY dimensions (m)	Rozměry CWY CWY dimensions (m)	Rozměry vzletového a přistávacího pásu Strip dimensions (m)	Prostor bez překážek OFZ	Poznámky Remarks
7	8	9	10	11	12
REZERVOVÁNO RESERVED	-	200x300	2400x300	-	RWY by měly být správně označeny 02L, C, R /21L, C, R, z důvodu možnosti záměny jsou 03L,C,R/21L,C,R. The correct designation of RWYs should be 02L, C, R/20L, C, R but due to a possible confusion they are designated 03L, C, R/ 21L, C, R.
	-	200x300		-	
	-	110x60	2000x60	-	
	-	200x60		-	
	-	320x135		2000x135	
-	200x135	-			

AD 2-LKKU-8		KUNOVICE			AIP	
11 DEC 03					CZECH REPUBLIC	
LKKU AD 2.13 VYHLÁŠENÉ DÉLKY						
LKKU AD 2.13 DECLARED DISTANCES						
Označení RWY RWY Designator	TORA (m)	TODA (m)	ASDA (m)	LDA (m)	Poznámky Remarks	
1	2	3	4	5	6	
03C	2000	2200	2000	2000		
21C	2000	2200	2000	2000		
03R	1690	1800	1690	1690		
21L	1690	1890	1690	1690		
03L	1480	1800	1480	1480		
21R	1480	1680	1480	1480		

The aircraft landed on RWY 21C. There is no turn pad at the end of the runway. After heavy rain immediately preceding the day of planned landing of the Fokker aircraft at the LKKU airport, the grass area surrounding the runway was thoroughly soaked with water. The airport marking was in compliance with the set requirements. The entire end of RWY 21C was lined with longitudinal white strips.

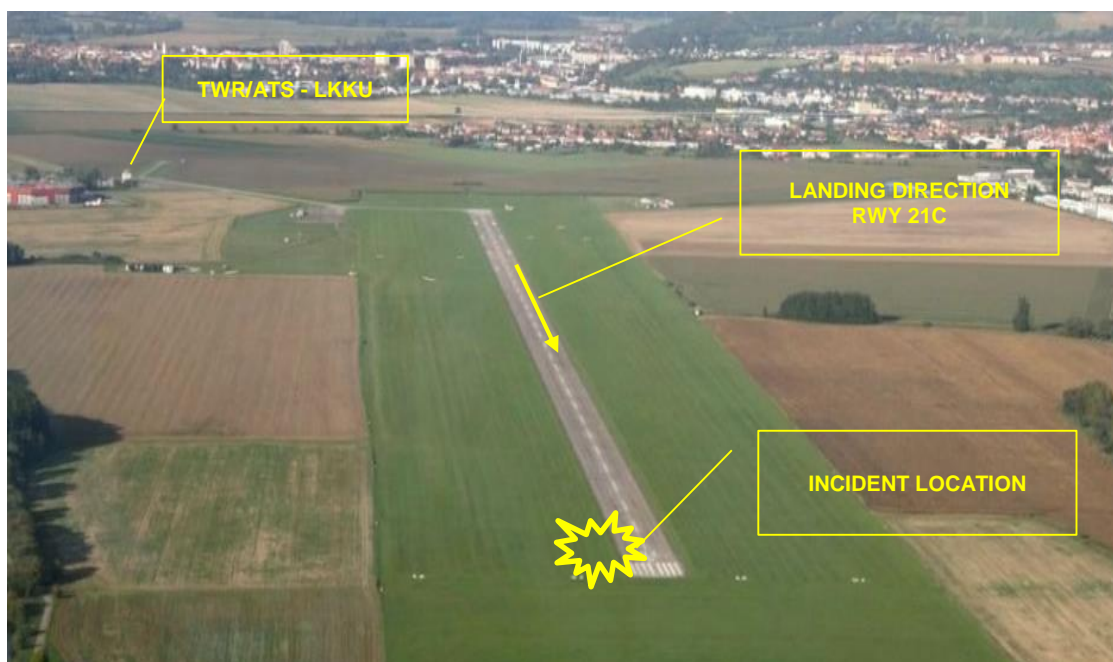
1.11 Flight Recorders and Other Means of Recording

After the incident the recording of the flight recorder has been provided by the aircraft operator. The recording was legible and has been used to analyse the final stage of aircraft's landing and taxiing on RWY.

The LKKU ATS has provided the recording of radio-communication between the crew and TWR. The recording was legible and comprehensible.

1.12 Incident Location Description

The incident was located at the end of RWY 21C (hereinafter the runway) at the right side. No tyre traces attributable to an aircraft of the Fokker type have been detected on the concrete surface of the runway. The traces of rolling aircraft front wheels started in the grass, 1.50 m from the centre of the runway, forming an approximate 10-15 degree angle with the edge of the Runway end, and finished 16.6 m from the right edge of the runway. The traces were 0.1 - 0.2 m deep and clearly visible up to the point of an aircraft full stop. The aircraft was turned to the right with its nose in the heading of 293 degrees. The virtual line connecting the axes of the main wheels was located 2.5 m from the right edge of the runway. The main wheels sank 0.1 - 0.15 m in the soggy grass surface at the edge of a drainage launder.



Incident Location Description

1.13 Medical and pathological Information

POB and crew no injured.

1.14 Fire

NIL

1.15 Survival Aspects

No search and rescue procedures were organised. The crew and the passengers disembarked the aircraft in a standard manner. The aircraft was then removed by the fire brigade from the Leoš Janáček Airport Ostrava (LKMT).

1.16 Tests and research NIL

1.17 Organizational and management information

1.17.1 Aircraft Operator

The aircraft is operated by M - Jet Aviation, a foreign business charter operator mostly serving to private entities. The company holds a valid licence for this scope of business activity.

1.17.2 LKKU (Kunovice) Airport Operator

The Kunovice airport is operated by a domestic company - Aircraft Industries a.s.

1.18 Additional information NIL

1.19. Useful or effective investigation techniques

The incident has been investigated according to L 13 National Regulation (Investigation into Air Accidents and Incidents of the Czech Republic) as per recommendation of ICAO - Annex 13.

2. Analysis

The analysis of the event situation has been based on the description of the traces left by the aircraft in grass, the records of the flight recorder and the recording of communication with TWR and it has been compared with the pilot's statement. The analysis has been limited only to the aircraft movement after decelerating to the taxiing speed up to the full stop.

2.1. Impact of Conditions and Aircraft Movement on the Ground

There were no tyre traces on the runway, i.e. all the wheels were rolling on the concrete surface without any hindrance. According to the assessment of the MAGHDG recording the landing was free of deviations from the given direction of the respective runway. After aircraft landing and decelerating to the taxiing speed of approx. 12 kt, the aircraft turned to the left up to the heading of 176 degrees. After that the aircraft started turning to the right in the heading of 180 degrees until the final position in the heading of 293 degrees. During this manoeuvre the speed was gradually decelerating from 12 kt to 3-4 kt. When turning the aircraft, the pilot was aiding the manoeuvre by an asymmetric

engine thrust; while the aircraft was positioned in the heading of 268 degrees, the number of revolutions between the left and the right engine differed by 22 per cent with the value of left engine revolutions being 45.2 per cent. It is thus possible that by increasing the performance of the left engine the pilot wanted to overpower the resistance of rolling wheels, which had been probably sunk in the soggy grass by that time.

The angle formed by the trajectory of the front gear wheels and the edge of the runway end proves that the wheel steering limit value of 76 degrees was reached. Therefore, we may deduce that the effort to free the aircraft by increasing the left engine thrust with a maximum displacement of the steering mechanism resulted in static overloading of the said mechanism and partial chipping of the mechanism gear teeth and thus in damaging of the system.

2.2. Impact of the Aircraft Design on Ground Manoeuvring and Manoeuvring Options for Turning by 180 Degrees on a Limited Runway

The respective aircraft flight and operating manual reads that a 22.2 m wide stripe is sufficient for maximum turning of front wheels to the angle of 76 degrees. This dimension applies to the position of main wheels on one of the stripe edges and is delineated by a circumscribed circle corresponding to the movement of the front wheels. The LKKU Runway (RWY 03C/21C) is 30 m wide. We may therefore deduce that the runway dimension was sufficient for turning of the aircraft by 180 degrees. In practice this procedure may be applied if the crew knows the given aerodrome well or when the aircraft turning is guided by the ground assistance service. In this particular case the crew after landing in the given direction required no assistance and the pilot failed to correctly estimate the initial position of the aircraft for safe turning. The pilot probably tried to free the aircraft with all his energy and gave up only when reaching a dead end.

From the point of view of suitability of the Kunovice airport for the given type of aircraft, the crew should consider the information published in AIP and apply the respective provisions of the operator's operating manual to suitability of use of the said airport. The information available implies that the aircraft operator requested the service for flight control from the Kunovice Airport. The aerodrome operator accepted the request and secured the service for the aircraft landing on the stated date including the full Fire and Rescue Team shift.

2.3 RWY 21C Stopend Configuration

The runway in the landing course 21C is bordered with a concrete surface boundary merging without any unevenness into grass surface. In terms of design, the boundary has the form of rectangular shape made of concrete and set in the surrounding grass turf. The concrete strip is 30 m wide. The 21C RWY stopend is not equipped with a turn pad.

The turn pad criteria are published in Appendix 4, Doc 9157 AN/901. The relevant provision in Article 3 recommends the proportions of the turn pad and the adjacent taxiway to accommodate aircraft turn with the maximum front wheel turn at 45 degrees. The geometric trajectory construction and calculation show that the width of the pad needs to be 36 m whereas the starting position of the main wheels would be closely on the edge of the pad.

3. Conclusions

3.1 The AAI Commission concludes the following:

- the pilot had an adequate experience in flying the stated type of aircraft and he was skilled and fit to fly;
- the aircraft was airworthy and had a valid aircraft airworthiness certificate;
- LKKU ATS issued a correct instruction for F100 landing;
- the pilot carried out the landing in RWY 21C course in accordance with the instruction issued and during the landing procedure and after touchdown did not notice any problems;
- the pilot estimated incorrectly the initial point from which the aircraft would start the 180 degrees turn and ran off the concrete surface of the runway;
- after the landing the pilot did not require any assistance, which he did only at the moment when he very likely ascertained that he would not be able to move the aircraft with his own power from the grass surface back to the concrete surface;
- the grass surface was soaked with water after the prior heavy rains;

3.2. Causes

Incorrect estimation of the initial point from which the aircraft would start the 180 degrees turn after landing and the crew's attempt to salvage the aircraft in their own strength can be identified as the causes of the incident.

4. Safety Recommendations

We recommend to the aerodrome operator to review and, if need be, implement further procedure description in providing assistance to similar types of aircraft in cases when the landing would be carried out in the RWY 21C course and in respect to the technical abilities and limits of both, the aircraft and the runway, and thus would be able to provide adequate service and assistance for aircraft ground control.

5. Appendixes

5.1. Pictures



Pic.1 A/C position

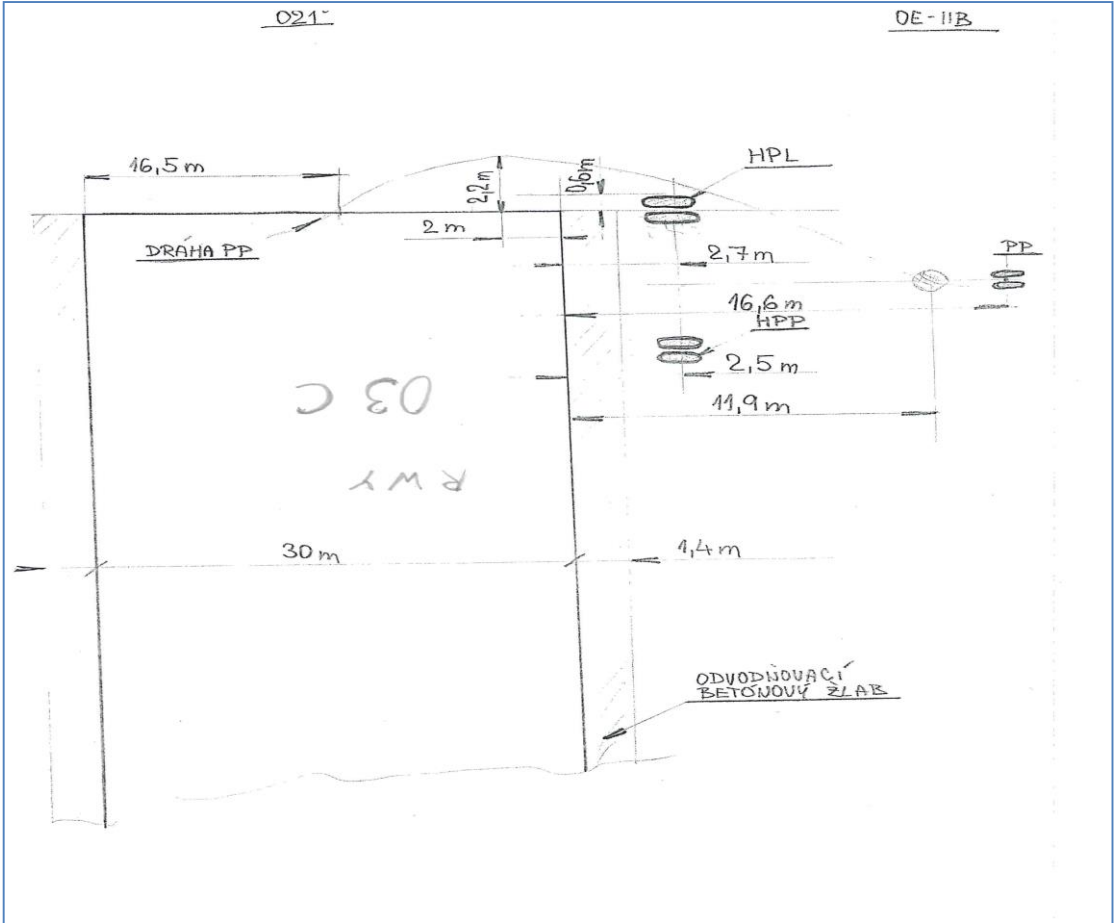


Pic. 2 Traces of front wheel



Pic. 3,4 Damage to the steering mechanism - p/n 200429305

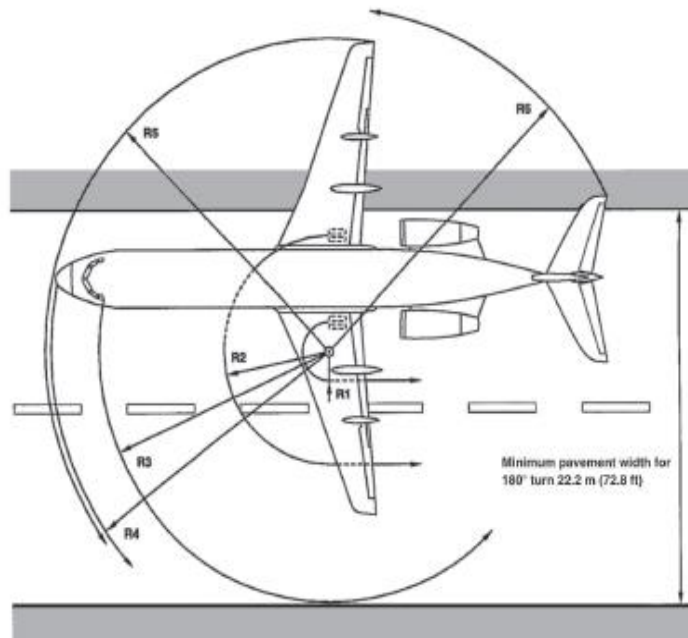
5.2 Scheme



1. Scheme of traces



TURNING RADIUS
STEERING ANGLE: 76°



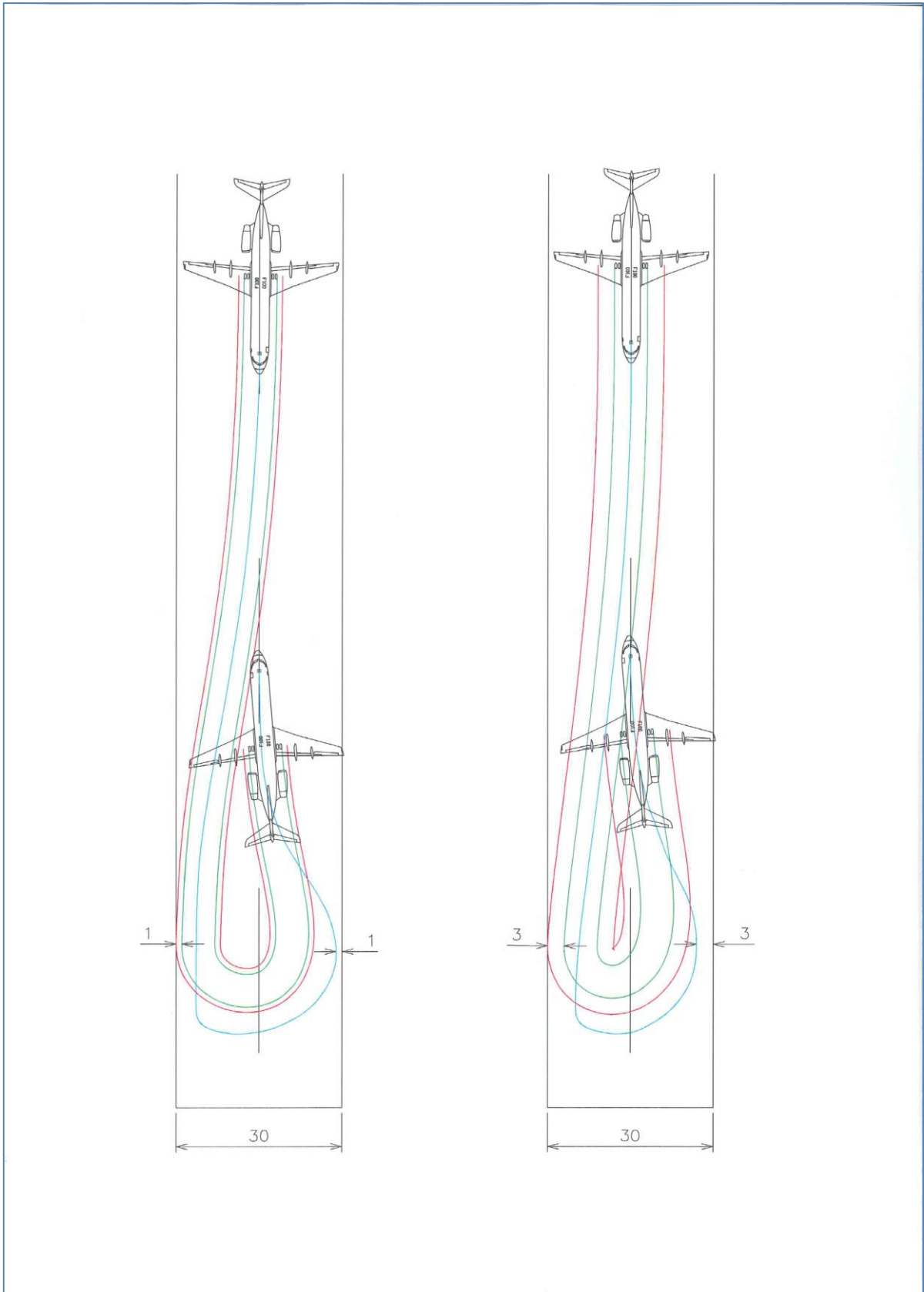
- R1 - 1.76 m (5.8 ft)
- R2 - 6.80 m (22.3 ft)
- R3 - 14.64 m (48.0 ft)
- R4 - 18.27 m (59.9 ft)
- R5 - 18.32 m (60.1 ft)
- R6 - 20.06 m (65.8 ft)

VDJOP-01-107/A

AOM FOKKER 100

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2. Scheme of U-turn Fokker F100, steering angle 76 degrees



3. Scheme U-turn Fokker F100 on RWY (wide 30 meters) and starting position of the main wheels would be closely on the edge of the pad 1 or 3 meters.