

Swiss Confederation

Büro für Flugunfalluntersuchungen BFU
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Aircraft Accident Investigation Bureau AAIB

Final Report No. 1969 by the Aircraft Accident Investigation Bureau

concerning the serious incident (near collision/AIRPROX)

between the Learjet 35, T781

operated by Swiss Air Force under flight number SUI 555

and the Boeing 737-600, TS-IOK

operated by Tunisair under flight number TAR 602

on 12 January 2006

3 NM north of CANNE (Monte Ceneri region)

Bundeshaus Nord, CH-3003 Berne

General information on this report

This report contains the AAIB's conclusions on the circumstances and causes of the accident/serious incident which is the subject of the investigation.

In accordance with Annex 13 of the Convention on International Civil Aviation of 7 December 1944 and article 24 of the Federal Air Navigation Law, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent future accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.

The definitive version of this report is the original in the German language.

All times mentioned in this report, unless otherwise indicated, follow the coordinated universal time (UTC) format. At the time of the accident, Central European Time (CET) applied as local time (LT) in Switzerland. The relation between LT, CET and UTC is: LT = CET = UTC + 1 h.

For reasons of protection of privacy, the masculine form is used in this report for all natural persons, regardless of their gender.

Final Report

Aircraft SUI 555, T781, Learjet 35A

Swiss Air Force

Dübendorf (LSMD) – Banja Luka (LQBK)

Type of operation: IFR, military flight

TAR 602, TS-IOK, Boeing 737-600

Tunisair

Tunis (DTTA) - Zurich (LSZH)

Type of operation: IFR, scheduled flight

Crews SUI 555

CMDR: Swiss citizen FO: Swiss citizen

TAR 602

CMDR: Tunisian citizen FO: Tunisian citizen

Location 3 NM north of waypoint CANNE

Date and time 12 January 2006, 08:17 UTC

ATC unit TC Zurich, Sector Upper U

Air traffic controllers Radar Executive Upper RE-U

Radar Planner Upper RP-U

Airspace C

1 History

1.1 Pre-flight history and history of flight

On the morning of 12 January 2006, a Swiss Air Force Learjet 35A, with the callsign SUI 555, took off from Zurich-Dübendorf on a flight to Banja Luka (Bosnia-Herzegovina). The first part of the flight route was via GERSA – N/UN850 - ODINA - UM727 - SRN. This was a military flight. The necessary rights relating to inward and transit flights were listed in the flight plan. The Learjet 35A was not equipped with an airborne collision avoidance system (ACAS II).

When the crew of SUI 555 made contact with Zurich Sector Upper (U), the aircraft was somewhat to the east of airway N850 on a direct heading to ODINA and had received clearance to climb to FL 240 from Zurich Sector South. According to the statement by the Radar Executive Upper (RE-U) air traffic controller (ATCO), he had a separation problem with an aircraft also flying south, which was still above SUI 555 at FL 270 and which was being coordinated at FL 250 with Milan Area Control Center (ACC). He therefore instructed SUI 555 to turn onto a heading of 165°, resulting in a flight path approximately mid-way between airways N/UN850 and Z/UZ651. At 08:12:46 UTC, after radar separation had been established with the other aircraft, the RE-U cleared SUI 555 to climb to FL 270. This flight level as well as the waypoint ODINA were coordinated with Milan ACC. The RE-U ATCO had earlier already agreed with the Radar Planner Upper (RP-U) ATCO that he should ask Milan ACC for a direct flight by SUI 555 to SRN. The coordination between the RP-U and Milan took place at 08:11:46 UTC. Milan ACC accepted the direct flight to SRN.

At 08:13:54 UTC, the RE-U ATCO cleared SUI 555 for the direct flight to SRN. Shortly afterwards, the crew were instructed to contact Milan ACC on the frequency 127.450 MHz.

The Tunisair Boeing 737-600, callsign TAR 602, was on a scheduled flight from Tunis to Zurich. Entry into Zurich ATC-controlled airspace was envisaged via CANNE – UZ651 – KELIP. This aircraft was equipped with ACAS II equipment, type TCAS, manufactured by Honeywell.

At 08:06:57 UTC, the crew of TAR 602 reported to Milan ACC and, after they had crossed another aircraft, received clearance to descend to FL 280. This flight level and the CANNE entry point were coordinated with Zurich air traffic control. While they were still in the area for which Milan is responsible, the crew of TAR 602 were instructed at 08:14:01 UTC to contact Zurich Sector U.

About 20 seconds after SUI 555 had taken leave of Zurich Sector U, the crew of TAR 602 made contact with this sector. At 08:16:28 UTC, the aircraft was flying at FL 280, 1.5 NM south of waypoint CANNE into the area for which Zurich Sector U was responsible.

At 08:14:54 UTC, the crew of SUI 555 made radio contact with Milan ACC: "Milano, hallo, SUI 555 level 270, inbound SRN, requesting level 390, negative RVSM, State aircraft".

The vertical area for which Milan ACC is responsible extends up to FL 290; above this, Rome ACC is responsible. The Milan ACC ATCO responsible therefore wished to coordinate a higher flight level for SUI 555 with Rome ACC. In a conversation lasting more than a minute, the Rome ACC ATCO drew attention to various aircraft which did not allow SUI 555 to climb further for the time being.

During this coordination conversation, at 08:16:15 UTC the responsible Milan ACC ATCO cleared SUI 555 for a direct flight to waypoint OSKOR and to climb to FL 280. At this time, TAR 602 was on an reciprocal track, offset by approximately 1 mile, and at a distance of some 12 NM from SUI 555. The left turn to OSCOR initiated shortly afterwards by the pilot of SUI 555 would take it directly towards TAR 602 and cross its flight path.

The RE ATCO at Zurich Sector U monitored the flight path of SUI 555 after he had handed it over to Milan ACC. According to his information, he observed on the radar monitor that SUI 555 remained at FL 270 for at least one minute. He then saw the FL 271 altitude readout on the radar monitor. He considered this to be within the radar tolerance. On the next radar update, about two to three NM before crossing TAR 602, the readout on the radar monitor was FL 274. According to the radar recording, the short term conflict alert (STCA) was also triggered at this moment. At 08:17:00 UTC, the RE-U ATCO informed the crew of TAR 602 of the conflict as follows: "Tunis air six zero two, there is traffic below you, climbing". The ATCO stated that he had added to this information the words "follow TCAS". These words were suppressed by the report of the TAR 602 crew. According to the voice transcript only the words "but f...." were audible. The ATCO stated that a complete traffic information was no longer possible for reasons of time. In addition, in his view it would no longer have been possible for the crew of TAR 602 to make visual contact with SUI 555.

The crew of TAR 602 later said that the TCAS had generated a resolution advisory (RA). The first officer, acting as pilot flying (PF), switched off the autopilot and initiated the climb ordered by the TCAS. According to the radar recording, the aircraft climbed to FL 289 before the crew descended back to FL 280. According to their information, they were unable to make visual contact with the other aircraft.

According to the statement by the crew of SUI 555, their aircraft was in a left turn towards OSKOR and passing FL 276. Immediately afterwards, TAR 602, coming from the 2 o'clock position, crossed SUI 555. The crew of SUI 555 became aware of the converging B737 by visual contact. The first officer (FO) detected the aircraft about 10 seconds and the commander (CMDR) about two seconds before the aircraft crossed.

The two aircraft crossed with an altitude difference of 700 ft and a lateral separation of 0.5 NM in the area of responsibility of Zurich Sector U; 4.5 NM north of the line of responsibility between Zurich ATC and Milan ATC.

After the serious incident, both aircraft continued to their destination.

1.2 Weather analysis according to MeteoSwiss

General weather situation

A weak occlusion north-west of Switzerland was making hardly any headway south and was weakening considerably. At the same time, in the course of the day, the influence of high pressure re-established itself.

Radio probes

The Milan radio probe (00z) indicated a dry layer of air at all altitudes. The winds at FL 270 were from the north-north-east, with a strength of about 30 kt. The temperature was -42°C and the dewpoint was -56°C.

Satellite image

On the south side of the Alps (Ticino), the cloud cover was very broken. The remaining parts of Switzerland were under a compact layer of cloud.

METAR

METAR of Lugano (LSZA) and Locarno (LSZL) at the time of the incident.

LSZA 120750 00000KT CAVOK M04/M04 Q1029 NOSIG LSZA 120820 00000KT CAVOK M03/M03 Q1030 NOSIG LSZL 120750 00000KT 0000 FEW180 M07/M09 Q1030 RMK BLAU LSZL 120850 21001KT 9999 FEW M05/M07 Q1030 RMK BLAU

Conclusion (according to MeteoSwiss)

Cloud: 2/8 at 13,000 ft AMSL, 6-7/8 at 25,000 ft AMSL (cirrus)

Weather: -

Visibility: over 30 km

Wind: north-north-east at 25 kt

Temp./dewpoint: -42°C / -56°C

Atmospheric pressure: QNH LSZA 1030 hPa, QNH LSZH 1032 hPa

Position of the sun: azimuth 135°, elevation 9°

Hazards: none detectable

1.3 International agreements

As already mentioned, SUI 555 was a military flight. The Chicago Convention, which regulates international civil aviation, states the following in this respect, in article 3:

Civil and state aircraft

- a) This Convention shall be applicable only to civil aircraft, and shall not be applicable to state aircraft.
- b) Aircraft used in military, customs and police services shall be deemed to be state aircraft.
- c) No state aircraft of a contracting State shall fly over the territory of another

State or land thereon without authorization by special agreement or otherwise, and in accordance with the terms thereof.

1.4 ATC Zurich operating regulations

Military flights abroad by the air force

According to its flight plan, SUI 555 was a military flight. In the ATC Zurich operating regulations (ATMM ZC), these flights were listed under the designation GAT (General Air Traffic).

Among other things, Part 5 ATMM ZC states, under the heading "Military flights abroad by the air force":

1.2 GAT (introduction)

The flight is fully under civil control and is therefore subject to all standard procedures, conditions and regulations (incl. aviation law) of civil air traffic control.

2.2. Equipment of aircraft (procedures)

In many cases, MIL aircraft are not equipped to civil standards. It shall therefore be indicated which service is desired (e.g. RMK/REQ RADAR GUIDANCE).

2.3 GAT (procedures)

MIL flights with a GAT flight plan are handled like civil flights, i.e. there are no changes to standard procedures.

ATC coordination procedure Zurich / Milan

The coordination procedures between Zurich air traffic control and Milan air traffic control were set down in the operating regulations of ATC Zurich (ATMM ZC) under PROCEDURES ADJACENT UNITS / MILAN.

The lines of responsibility (LoR) lay on a straight line from ODINA via ABESI to the national frontier between Switzerland and Italy, subsequently following the national frontier in a northerly direction.

In the present case, the following procedures were applied:

Flights in a northerly direction with destination Zurich were cleared on RNAV Route CANNE Z/UZ651 at FL280 or lower.

Flights in a southerly direction departing Zurich were cleared on RNAV Route N/UN850 ODINA, generally to FL 250 or lower. If the aircraft was able to pass waypoint ODINA at FL 270, this flight level could also be assigned.

Under section 4.2, the following was listed for coordination by telephone, among other things:

Coordination by telephone is required for:

- deviations from standard routings
- deviations from standard FL

The transfer of aircraft was regulated under section 9:

Transfer of Communication
As early as practicable, but not later than at the LoR.

2 Analysis

2.1 Flight path of SUI 555 and ATC aspects

The Zurich Sector U RE ATCO guided SUI 555 with a heading instruction to the east of the scheduled route N/UN850, in order to ensure separation from another aircraft. His intention to assign the crew of SUI 555 a direct flight to SRN, thereby shortening the flight route, can be considered as appropriate, even if as a result SUI 555 and TAR 602 were flying on opposing headings. The statements and recording show that the RE ATCO at Zurich Sector U was aware of this problem and was paying increased attention to the situation.

SUI 555's flight was originally scheduled via waypoint ODINA with Milan ACC. The Zurich Sector U ATCO had coordinated SUI 555's direct flight to SRN with Milan ACC in good time.

The transfer of an aircraft to the frequency of the next control unit before the LoR must not be equated with a simultaneous clearance for changes in altitude or heading to the ATC unit which is taking over. In the agreements between air traffic control units, a distinction is therefore made between transfer of communication and transfer of responsibility.

In the present case, the Zurich Sector U RE ATCO had transferred SUI 555 to Milan ACC at 08:14:08 UTC, about four minutes before it left his area of responsibility. This corresponded to the agreement with Milan ATC, which mentions the transfer of communication "as early as possible, but not later than at the LoR".

In the present case, the LoR between Zurich ATC and Milan ATC lies on a straight line from ODINA via ABESI to the national frontier between Switzerland and Italy. Until it flew over this line, SUI 555 should have maintained the FL 270 assigned by Zurich Sector U and the heading towards SRN. A change in SUI 555's flight level and heading would have required telephone coordination with Zurich Sector U. This procedure was laid down in the ATMM ZC / PROCEDURES ADJACENT UNITS / MILAN.

According to the radar recording, the STCA alarm was triggered when SUI 555 passed FL 274, a few seconds before crossing TAR 602. The RE-U ATCO no longer had sufficient time to issue a complete traffic information.

It is impossible to judge definitively why Milan ACC gave SUI 555 clearance for the climb to FL 280 when it was in Zurich Upper U airspace. It seems that when the Milan ACC ATCO gave the clearance to climb to FL 280 he was not aware that SUI 555 was still within the area of responsibility of Zurich Sector U. In this context, the Italian ENAV S.p.A. (Società Nazionale per l'Assistenza al Volo), which investigated the serious incident internally, writes: "...it's quite clear that one of the main contributing factors was the controller's loss of situational awareness".

2.2 ACAS II aspects

The Swiss Air Force Learjet is a state aircraft, which does not fall under the Chicago Convention and does not therefore have to meet the requirements of civil aircraft. On the other hand, overflying or landing authorisation is required for state aircraft. For the use of specific airspace, each state may require specific systems to be present on the aircraft in order to guarantee general safety in such airspace. In the present case, the Learjet was not equipped with ACAS II.

The clearance to climb to FL 280 given to SUI 555 by Milan shortly before the aircraft crossed TAR 602 led to this serious incident. Since the Learjet was not equipped with ACAS II, the crew had no information about the impending conflict. This meant that only the Boeing 737-600, which was equipped with an ACAS II, took avoiding action on the basis of a TCAS RA.

This high rate of convergence and the circumstance that both aircraft initially had the minimum vertical separation of 1000 ft led, after the initiation of SUI 555's climb, directly to the triggering of a resolution advisory (RA) without the crew of the Tunisair B737-600 first being warned of the impending conflict by a traffic advisory (TA).

Despite the short reaction time available, the crew of TAR 602 were able, after the TCAS had generated an RA, to initiate a climb and defuse the situation. If the SUI 555 Learjet had also been equipped with a TCAS, the crew would have been able to detect the opposing aircraft on the TCAS traffic display and react accordingly.

Since both crews were carrying out a frequency change almost simultaneously, SUI 555 to Milan ACC and TAR 602 to Zurich Sector U, they had no information available from radio conversations about the presence of the other aircraft.

3 Conclusions

3.1 **Findings**

 SUI 555 was flying according to instrument flight rules and was in contact with Milan ACC on the 127.450 MHz frequency at the time of the serious incident.

- TAR 602 was flying according to instrument flight rules and was in contact with Zurich Sector U on the 133.050 MHz frequency.
- At 08:12:46 UTC, Zurich Sector U cleared SUI 555 to climb to FL 270. This flight level was coordinated with Milan ACC for the transfer.
- At 08:12:54 UTC, Zurich Sector U cleared SUI 555, in agreement with Milan ACC, to fly direct to SRN.
- At 08:16:15 UTC, Milan ACC cleared SUI 555 for the direct flight to OSKOR and for the climb to FL 280. At this time, SUI 555 was within the area of responsibility of Zurich Sector U.
- Milan ACC had cleared neither the climb nor the direct flight of SUI 555 to OSKOR with Zurich air traffic control.
- At 08:17:00 UTC, the Zurich Sector U ATCO issued TAR 602 with traffic information about SUI 555, which crossed a few seconds later.
- The Tunisair B737 was equipped with a TCAS Type 2 change 7, model Honeywell TPA-81A.
- The TCAS in TAR 602 generated an RA advisory, which was obeyed by the crew. According to the radar recording, TAR 602 climbed to FL 289. The crew were unable to establish visual contact with SUI 555.
- The Swiss Air Force Learjet was not equipped with ACAS. The crew were able to establish visual contact with TAR 602.
- SUI 555 was on a flight with military status.
- The Chicago Convention applies only to civil aircraft.
- Both flight crews as well as the air traffic controllers in Zurich and Milan possessed the licences necessary to exercise their activity.
- The serious incident occurred 3 NM north of waypoint CANNE inside the area of responsibility of Zurich air traffic control.
- At 08:16:58 UTC, according to the radar recording, the minimum lateral separation between SUI 555 and TAR 602 was measured as 0.5 NM. The altitude difference was 700 ft.

3.2 Cause

The serious incident is attributable to the issuing of instructions by ATC to an aircraft outside its own area of responsibility.

4 Measures taken

According to the information of the Swiss Air Force all of their transport aircraft are at present equipped with TCAS.

Berne, 15 January 2008

Aircraft Accident Investigation Bureau

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TRANSCRIPT OF TELEPHONY

OR RADIOTELEPHONY COMMUNICATION TAPE-RECORDINGS

Investigation into the incident that occurred on 12.01.2006

- Subject of transcript: SUI555 / TAR602

- Centre concerned: Swiss Radar Area East

- Designation of unit: Zurich Upper

- Frequency / Channel: 133.05 MHz

- Date and period (UTC) covered by attached extract: 12.01.2006

08:12-08:20 UTC

- Date of transcript: 23.01.2006

- Name of official in charge of transcription:

- Certificate by official in charge of transcription:

I hereby certify:

- That the accompanying transcript of the telephony or radiotelephony communication tape-recordings, retained at the present time in the premises of the Analysis Department, has been made, examined and checked by me.
- That no changes have been made to the entries in columns 2, 3 and 4, which contain only clearly understood indications in their original form.

Zürich, 23.01.2006



Abbreviations

Sector Designation of sector

U - Zurich Upper T-U - Telephone Upper T-MIL - Telephone Milano

Aircraft -	<u>Callsign</u>	Type of acft	Flight rules	<u>ADEP</u>	-	<u>ADES</u>
SUI555 -	Swiss Air Force	LJ35	IFR	LSZH	-	LQBK
TAR602 -	Tunair (Tunis Air)	B736	IFR	DTTA	-	LSZH
DLH2JL -	Lufthansa	B733	IFR	EDDF	-	LIML
DLH3LM -	Lufthansa	CR1J	IFR	LSGG	-	EDDM
HLF283 -	Hapag Lloyd	B738	IFR	EDDM	-	LPMA

DMOsn / 23.01.2006

TRANSCRIPT SHEET

Occurrence: SUI555 / TAR602 of 12.01.2006



 To
 From Time
 Communications
 Observations

 Col.1
 Col.2
 Col.3
 Col.4
 Col.5

Frequency: Zurich Upper 133.05 MHz

555	U	08:12:46	Swiss Air Force triple five, climb level two seven zero
U	555	:49	Cleared to climb level two seven zero, Swiss Air Force triple five
2JL	U	:52	Lufthansa two Juliet Lima, descend level two five zero
U	2JL	:56	Lufthansa two Juliet Lima, descending level two five zero
283	U	:13:23	Hapag Lloyd two eight three, identified, Trasadingen and BENOT
U	283	:30	Hapag Lloyd two eight three, Trasadingen, BENOT
283	U	:37	Hapag Lloyd two eight three, climb level three two zero
U	283	:40	Flight level three two zero, Hapag Lloyd two eight three
283	U	:42	Correct, Radar one three four decimal six zero five, good bye
U	283	:48	One three four six zero five, Hapag Lloyd two eight three, bye
555	U	:54	Swiss Air Force triple five, own navigation direct to Saronno
U	555	:14:01	Direct Saronno, Swiss Air Force triple five
555	U	:08	Swiss Air Force triple five, contact Milano one two seven decimal four five, good bye
U	555	:13	Two seven four five, bye bye
U	2JL	:20	Reaching, maintaining flight level two five zero, Lufthansa two Juliet Lima
2JL	U	:24	Thank you, contact Milano one two seven decimal four five, good bye
U	2JL	:26	Milano, one two seven four five, "danke schön", "Tschüss"
U	602	:30	Zurich, good morning, Tunair six zero two
602	U	:33	Tunis Air six zero two, good morning, squawk seven five

TRANSCRIPT SHEET

Occurrence: SUI555 / TAR602 of 12.01.2006



To Col.1	From Col.2	Time Col.3	Communications Col.4	Observations Col.5
			two one	
U	602	08:14:37	seven five two one, roger	
602	U	:17:00	Tunis Air six zero two, there is traffic below you, climbing, but f	overlapping transmission
U	602	:04	Äh, Zurich, Tunair six zero two, TCAS, TCAS contact	
U	602	:11	TCAS climb, Tunair six zero two	
U	602	:20	Tunair six zero two, right now, twenty eight thousand feet eight hundred, we are descending two eight zero	
602	U	:33	Tunis Air six zero two, roger, that was a problem with Milan, we are sorry about, descend flight level two five zero	
U	602	:43	Okay, descending flight level two five zero	
3LM	U	:18:26	Lufthansa three Lima Mike, contact Munich one three three decimal five five, bye	
U	3LM	:29	one three three five five, "Tschüss", Lima Mike	
602	U	:45	Tunis Air six zero two?	
U	602	:48	Go ahead Sir	
602	U	:50	Tunis Air six zero two, you are identified and cleared for a KELIP three Echo arrival	
U	602	:56	KELIP three Echo arrival, Tunair six zero two, descending level two five zero	
602	U	:19:00	Tunis Air six zero two, this is correct, and for your information, we will have to file a report about your TCAS climb to start an internal or external investigation	
U	602	:20	For us, we will not "passing" for a report, nor problem for that	

- end -

