

Investigation Report

Identification

Type of Occurrence: Incident

Date: 18 October 2021

Location: TRA Lauter (ED-R205)

Aircraft 1: Fighter Jet

Manufacturer: Panavia Aircraft

Type: PA-200 (Tornado)

Aircraft 2: Airplane

Manufacturer: Cirrus Design Corporation

Type: SR 22

Injuries to persons: No injuries

Damage: None

Other Damage: None

State File Number: BFU21-0957-RX

Abstract

In the Temporary Reserved Airspace (TRA) Lauter (ED-R205), an airprox occurred involving a PA-200 (VFR) and a SR 22 (IFR). The closest lateral distance was 0.4 NM and the vertical 200 ft.

Factual Information

History of the Flight

The SR 22 crossed the TRA in south-eastern direction at FL 100. The two PA-200 used the TRA for air combat exercises between FL 100 and FL 240. In the process, an airprox occurred involving one of the two PA-200 and the SR 22. The closest lateral distance was 0.4 NM and the vertical 200 ft.

PA-200

The flight crews of the PA-200 formation, consisting of two aircraft, checked in at 0955:59 hrs¹ on the frequency of the responsible Control and Reporting Center (CRC). On board of each of the two PA-200 were the Pilot in Command (PIC) in the front seat and a Weapons System Officer (WSO) in the back seat. Basic Fighter Manoeuvres (BFM) exercises were to be flown. There are always two aircraft involved, one takes over the role as attacker, the other the one as defender. The aim of the attacker is to get behind the defender into a good shooting position. The defender intends to prevent this. In the process, large vertical movements at a relatively small lateral extension are flown.

After check-in, the flight crews received information as to the control method, the available airspace and existing restrictions. *"[...] radar contact, loose positive control², you are cleared to operate TRA two zero five, flight level one hundred up to two four zero, ED-R one one six Baumholder not active."* At 0956:14 hrs, the two PA-200 were under radar control of the CRC. Ramstein TACAN³ was original the reference point for targeting. The reference point was called "GIN". According to the available information, an Alpha Check was not performed. Thereby is verified if CRC and the flight crews are using the same reference point.

At 1001:48 hrs, after the first exercise, the flight crews received traffic information about the SR 22 and a new lowest usable flight level (FLOOR) of FL110: *"[...] lowest useable flight level one one zero due to stranger GIN three two five, niner, flight level one hundred, track south-east."* The flight crew did not acknowledge this instruction. After the CRC enquired if the instruction had been understood the leader of the

¹All times local, unless otherwise stated.

² The CRC is responsible for the separation to third-party traffic. The flight crews can determine bearing, altitude and speed themselves.

³ Tactical Air Navigation

formation asked to repeat it. The AC⁴ responsible repeated: “[...] *lowest useable one one zero.*” The leader of the PA-200 formation confirmed this: “*Copy, lowest one one zero [...]. Read you now again five by five.*” The AC did not issue another traffic information. The flight crews were not informed about the clearance the SR 22 had received to cross the TRA and they were also not asked to consent. According to the statement of the German Armed Forces, this is no longer necessary, after a change in procedures in 2020. The clearance for transit was issued before the TRA was used.

According to the available statements of the PA-200 flight crews, the PIC of the PA-200 involved processed the altitude restrictions not completely and began the next exercise in the assumption that FL 100 was still the lowest usable flight level. The WSO assumed FL 110 as lowest usable flight level. The SR 22 was indicated, but he did not view it as risk because it was in FL 100. According to his statement, the WSO said “FLOOR” while passing FL 120. The PIC assumed, according to his own statement, that 2,000 ft were still available to finish the exercise in time. At 1004:45 hrs, while passing FL 110, the WSO terminated the exercise with the word “Terminate”. Now the PIC became aware that the instructed FLOOR of FL 110 was infringed, according to his statement. Almost at the same time, the CRC radioed with the new FLOOR (FL 120) combined with the traffic information: “*Stranger⁵ BRAA⁶ zero six six, seven*”. In fact, the direction and distance information referred to the reference point “GIN”. According to the available recordings, this occurred at about 1004:50 hrs. The radar data showed that at about the same time, the airprox involving the PA-200 and the SR 22 occurred. The flight crew acknowledged the information about a raised FLOOR to FL 120 with their callsign. At 1005:15 hrs, the flight crew of the PA-200 involved reported that they had visual contact with the SR 22 and asked whether it was within the TRA. After the AC had confirmed this, the head of the PA-200 formation decided to move the exercises to the western part of the TRA (sector A+D) and requested the entire airspace up to FL 240 for the training.

⁴ Aircraft Controller

⁵ Third party traffic

⁶ Bearing Range Altitude Aspect, in relation to one's own position

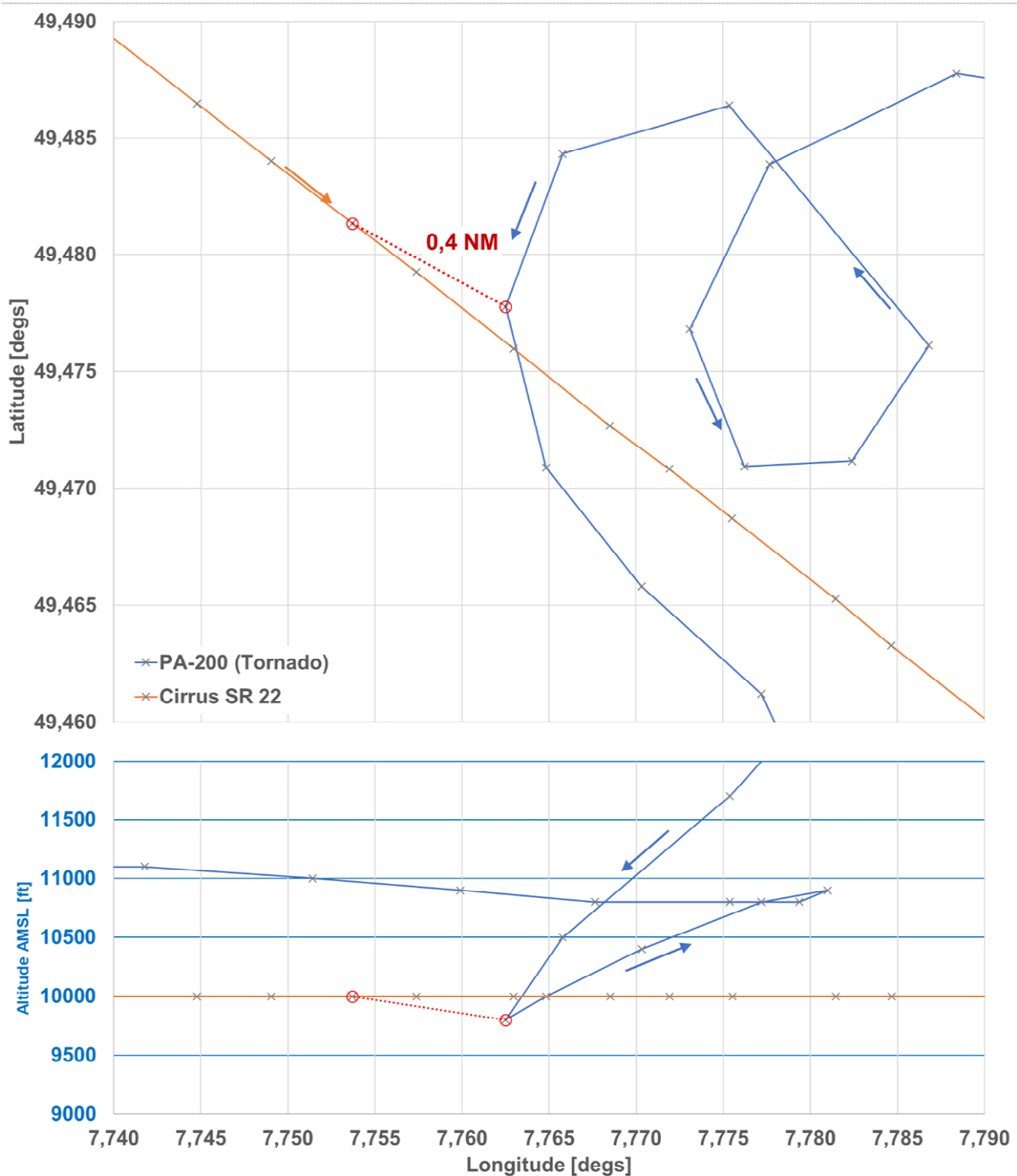


Fig. 1: Flight paths

Source: Air traffic service provider, adaptation BFU

SR 22

The SR 22 was on an IFR flight from Antwerp, Belgium, to Lugano, Switzerland. On Board were the PIC and one passenger. The SR 22 pilot stated that he had been flying

as instructed by ATC when he saw a military aircraft which crossed his flight path. It had not been flying straight but had manoeuvred. The military aircraft had left his field of vision very quickly again. Visibility had not been limited. He reported the airprox to Langen Radar. The responsible controller confirmed with “Roger”. The pilot stated that he had flown with activated autopilot. Flight level 100 had been selected.

CRC

According to the statement of the persons involved, originally an exercise with three PA-200 was planned. For this, the Aircraft Controller Assistant (ACA) was scheduled as AC, because he was qualified for Air Combat Tactics (ACT). Prior to take-off, the CRC received the information that only two of the three PA-200 would participate in the exercise. Since the ACA had the required qualifications, ACA and AC changed positions. This should enable her to gain more experience. It was coordinated with the Fighter Allocator (FA) and approved by him.

Between 0950:09 hrs and 0950:52 hrs, coordination between the planning controller of Langen Radar and the ACA of the responsible control station took place. It was agreed that the SR 22 was allowed to cross the TRA at FL 100 with a south-eastern bearing towards Karlsruhe. At 0955:22 hrs, Langen Radar handed the two PA-200 over to the CRC frequency.

After the first exercise, the AC raised the FLOOR from FL 100 to FL 110. She stated that she had had the plan to raise it to FL 120 or to separate the two PA-200 laterally to the SR 22. She had shared this plan with her assistant. He was an experienced AC, trainer and examiner, and the responsible AC said he recommended to raise the FLOOR only to FL 110, which she then did. At 1004:41 hrs, the FA recommended that the AC raise the lowest usable flight level to FL 120: “[...] *recommend floor one two zero, when you BFM over the traffic.*” At 1004:50 hrs, the AC instructed the two PA-200 by radio: “[...] *floor one two zero, due to stranger GIN zero six six, seven, flight level one hundred, track south-east.*” At that time, the airprox had already occurred and the two PA-200 terminated the exercise.

All aircraft involved continued their flights as planned.

Personnel Information

PA-200

Pilot in Command

The 34-year-old pilot held a military pilot licence issued on 27 March 2014 by the Tak-tisches Luftwaffengeschwader 51 with the following ratings:

Type rating Tornado (PA-200) valid until: 1 December 2022

IR valid until: 1 December 2022

His medical was valid until 1 December 2022 without restrictions.

He had a total flying experience of more than 1,500 hours; of which more than 650 hours were flown on type. In the last 90 days prior to the occurrence he had flown more than 60 hours.

On the day of the occurrence, start of duty was at 0630 hrs. Prior to that he had had the weekend off.

Weapons Systems Officer

The 43-year-old WSO held a military aircraft crew licence issued on 24 March 2011 by the Jagdgeschwader 71 (Fighter Wing) with the following ratings:

Type rating Tornado (PA-200), WSO valid until: 1 April 2022

His medical was valid until 1 April 2022 with the following restrictions: Wearing correc-tive glasses and carrying a replacement.

He had a total flying experience of more than 3,600 hours; of which more than 1,200 hours were flown on type. In the last 90 days prior to the occurrence he had flown more than 60 hours.

On the day of the occurrence, start of duty was at 0630 hrs. Prior to that he had had the weekend off.

SR 22

The 52-year-old pilot held a Private Pilot License (PPL(A)) issued by the Belgian Civil Aviation Authority on 20 June 2017 with the following ratings:

SEP (Land)

PIC valid to: 30 June 2023

EIR⁷ (SE)

valid to: 28 February 2022

Night

no expiry date

He had a class 2 medical certificate valid until 30 January 2022, with the restriction VML⁸.

He had a total flying experience of 483 hours, of which 171 hours as EIR. According to his statement, he had a flying experience on military aircraft of about 2000 hours.

Langen Radar

Radar Controller

On the day of the occurrence, the 32-year-old controller did not have a valid licence. On 4 April 2020 it had expired. The air navigation service provider stated that the Federal Supervisory Authority for Air Navigation Services (BAF) had not been able to issue licences in a timely fashion and are behind. The BAF had not renewed the licence in time but all requirements for a renewal were met. In the licence the BAF issued on 18 November 2021, the rating for the workstation involved was valid until 4 April 2023. His medical certificate was valid until 4 April 2022.

Planning Controller

The 52-year-old controller held an air traffic controller license issued by the Federal Supervisory Authority for Air Navigation Services on 18 January 2021. The type rating for the workstation involved was valid until 12 March 2024. His medical certificate was valid until 13 March 2022.

CRC

Aircraft Controller

The 29-year-old AC held a military aircraft controller licence issued by the German Military Aviation Authority, initially issued on 2 September 2021. Her medical was valid until 18 October 2022 with the restriction to wear glasses.

⁷ Correction for defective distant, intermediate and near vision

Aircraft Controller Assistant

The 59-year-old ACA held a military aircraft controller licence issued by the German Military Aviation Authority, initially issued on 9 March 1987.

He also held the rating as trainer, valid until 22 March 2022, and examiner, valid until 28 November 2022.

His medical was valid until 3 June 2022 with the restriction to wear glasses.

Aircraft information

Panavia Aircraft GmbH / PA-200 (Tornado)

The aircraft type involved is a two-seat fighter jet with two Turbo-Union RB199-34R jet engines. Maximum take-off mass is 25,500 kg. The aircraft is controlled by the pilot in the front seat. The person in the aft seat (WSO) control radar and the weapons systems.

The aircraft had a German certificate of registration and was operated by the German Armed Forces.

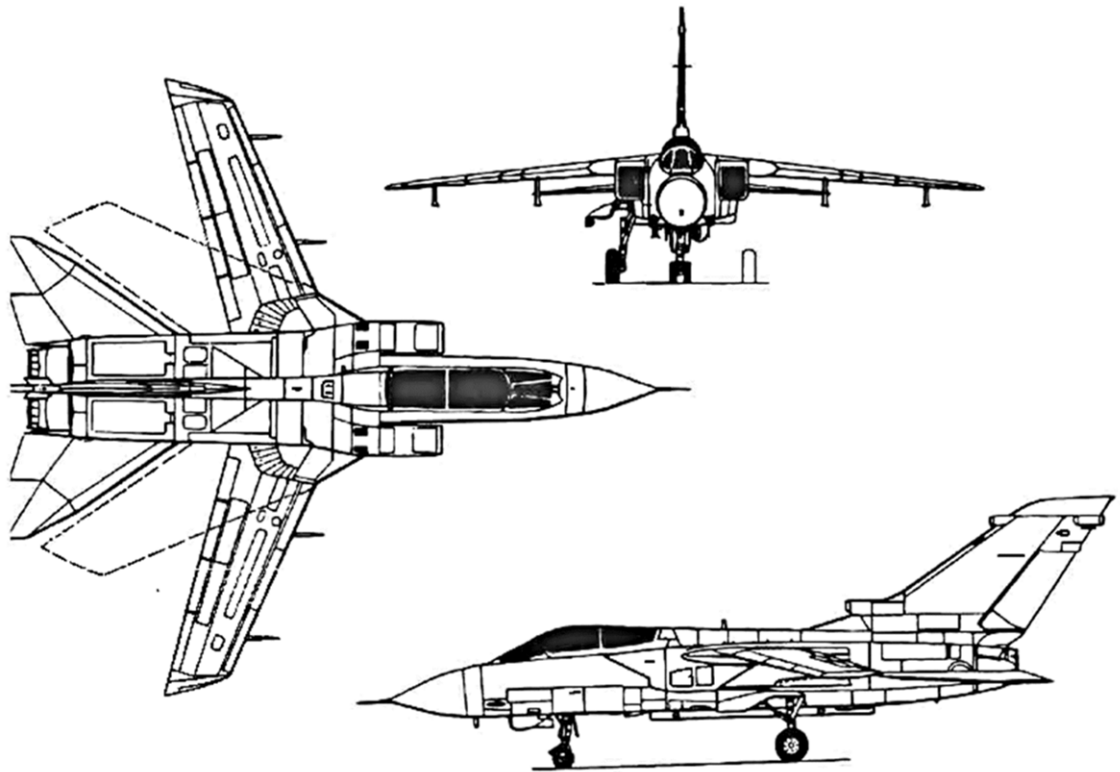


Fig. 2: Three-way view PA -200

Source: DFS

Cirrus Design Corporation / SR 22

The aircraft type involved was a four-seat, single-engine low-wing aircraft equipped with a piston engine; manufacturer's serial number 0801, year of manufacture 2004. Maximum take-off mass is 1,542 kg.

The SR 22 had a German certificate of registration and was operated by a Belgian company.

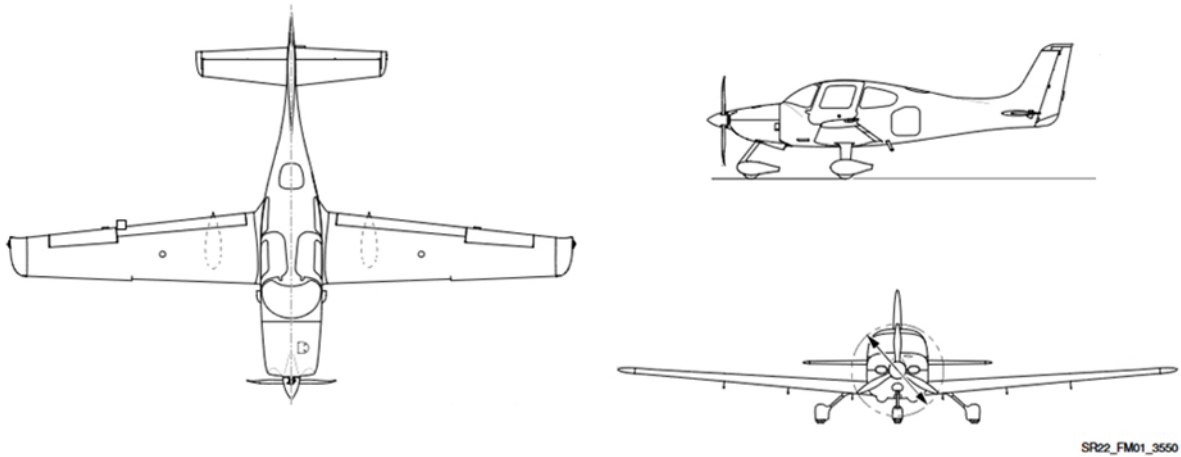


Fig. 3: Three-way view SR 22

Source: Flight manual

Meteorological Information

The aviation routine weather report (METAR) of the military airfield Ramstein, located below the TRA, of 0956 hrs showed the following weather information:

Surface wind: 000°, 0 kt,

Ground visibility: 200 m

Fog

Vertical visibility: 100 ft

Temperature: 5°C, dewpoint: 5°C

QNH: 1,025 hPa

According to the flight crews, Visual Meteorological Conditions (VMC) prevailed.

The sun was in the direction of 125°, about 15° above the horizon.

Radio Communications

Radio communications between the flight crews and control units involved were recorded and made available for the investigation as transcript and audio file (CRC Lone-ship).

Airspace Information

The Temporary Reserved Airspace Lauter is established for military training. It is divided into four quadrants (A-D). Depending on need, these quadrants can be activated individually. The lowest usable flight level is FL 100. Upwards it is unlimited. In accordance with a contractual agreement between DFS, EUROCONTROL and Air Force, air navigation service provider and airforce control military flying operations within the TRA. If the training tactically requires it the exercise is controlled by the military. Military control is not required by BFM.

During use of the TRA transit is prohibited.

Flight Recorder

The air traffic service provider provided the BFU with the radar data. Using this data, the flight paths could be reconstructed.

Organisational and Management Information

Clearance of Third-Party Traffic through Airspace used by the Military

On principle, it is possible, and is practised regularly, that civil and military traffic may fly through used military training airspace. This has to be coordinated beforehand between the responsible control units. Generally, a certain altitude and bearing are cleared. Permission to cross a used military training airspace depends on the situation and is approved or denied in accordance with the responsible organisation. On principle, no other traffic should be in a used TRA. If other traffic is cleared and is within the military training airspace the respective control unit is responsible for the separation of the training traffic.

Termination of Air Combat Training if Flight Safety is Endangered

The NATO regulation AM 75-2-1 defined the terms “Knock it off” and “Terminate” and described their use. Chapter 3-10 described the differentiation between the use of “Terminate” and “Knock it off”.

3-10. Termination of Manoeuvring.

a. Termination Radio Calls.

(1) To terminate local engagements, aircrew are to clearly identify aircraft and/or

position and transmit "C/S, TERMINATE" on a common/working frequency or Guard, followed by a wing rock if practical. This will not affect the entire scenario. If the radio is busy at the time of "TERMINATE", process with continuous wings rock, execute "Terminate actions" and then make the appropriate radio call.

(2) In case a flight safety hazard exists, transmit "C/S, KNOCK IT OFF" on a common/working frequency or Guard. This will affect the entire scenario and all aircraft will cease manoeuvring.

(3) If in doubt whether "TERMINATE" or "KNOCK IT OFF" is appropriate, "KNOCK IT OFF" will be used.

The term "Knock it off" is to be used whenever a situation exists which endangers flight safety.

The national military regulations referred in the general rule C2-271/0-2000-93 "Flugbetriebshandbuch III/1 Kampfflugzeuge" Chapter 10 to the use of the stipulations of the AM 75-2-1

Traffic Information

The general rule "Radarleitung und Radarunterstützung", A1-272/3-8902 stipulated in Section 6.7 the following:

Warnings of third-party traffic ("STRANGER WARNINGS") are to be issued if it can be foreseen that the flight path of the guided aircraft comes so close to the position or the assumed flight path of the other aircraft that the attention of the pilot has to be drawn to the airprox. [...] In addition, warnings always have to be issued, regardless of the current relative altitude difference, when

the approaching aircraft is in climb or descent or there is no Mode-C altitude information of the approaching aircraft. [...] Warnings have to be issued until the pilot has visual or radar contact with the other aircraft or the risk of infringement of the agreed minimum distances is ruled out.

[...] The pilot has to be informed once the risk does no longer exist.

Issuance of traffic information can be in the BRAA or the BE⁹ format. If the BE format has to be used an alpha check has to be performed at the beginning of the exercise with the flight crews involved. Distance and direction of the aircraft involved to the BE are verified. If the BRAA format is used, the flight crew involved receives traffic information in relation to their own aircraft (direction, distance, altitude, approach angle). The Bullseye format gives traffic information in relation to the Bullseye. Several aircraft can be informed about a target or third-party traffic at the same time.

⁹ Bullseye – predetermined reference point

Analysis

Individual Actions

PA-200

PIC PA-200

The flight crew properly acknowledged the altitude restriction of FL 110. However, the PIC of the PA-200 involved had not sufficiently internalised this restriction. The training scenario should have been terminated in time. Due to his own expectations that the FLOOR was at FL 100, he did not pay enough attention to the WSO's reference that the FLOOR had been reached. Based on the available radio communications and the statement of the flight crew, it can be assumed that the PIC did not know about the SR 22 being within the TRA up until the airprox occurred. It is highly likely that he would have relocated the training scenario into the western part of the TRA. After the airprox, he did do that for the rest of the exercises.

The flight crew did not properly acknowledge that the CRC raised the lowest usable flight level to FL 120. However, at that time the airprox had already occurred. Therefore, it is irrelevant whether the PIC had observed this instruction and implemented it. However, the PA-200 infringed the previously stipulated lowest usable flight level of FL 110. This resulted in the airprox with the SR 22.

The two PA-200 conducted BFM. In the process, the flight crews are required to perform at the highest physical and cognitive level. During such exercises the danger is high that altitude restrictions are not strictly adhered to. The lowest usable flight level of FL 110 should not have been infringed.

Weapons Systems Officer

The WSO gave the PIC the information "FLOOR" while passing FL 120. He had all necessary information about the SR 22, but he did not consider it a risk because it was in FL 100. He assumed that the PIC was aware of the FLOOR being FL 110. The WSO terminated the training scenario with the term "Terminate" once they passed the FLOOR. The term "Knock it off" should have been used because flight safety was at risk. It is highly likely that the PIC would have reacted more quickly and the airprox with the SR 22 could have been avoided.

SR 22

Pilot in Command

Once he passed the PA-200, he became aware of the airprox. There was no longer time for an avoidance manoeuvre. Beforehand, he had not received any information about the training military traffic within the TRA.

CRC

Aircraft Controller

Due to the control method (loose positive control), the AC was responsible for the adherence to minimum distances to third-party traffic. The flight crews were free in their choice of manoeuvres. The AC knew about the SR 22, its heading and the cleared altitude. She did not sufficiently ensure that the training flight crews were informed about the SR 22 which was within the training airspace. She did not implement her previous plan to separate the aircraft laterally and raise the FLOOR in time to FL 120. It has to be assumed that the experience of her ACA as AC, trainer and examiner and his dissent prevented her from doing so.

Only spatial separation would have safely prevented the airprox. A safety margin of 2,000 ft is much better than just 1,000 ft. The BFU is of the opinion that vertical separation to third-party traffic is not feasible during air combat training where the flight crews can decide themselves about altitude, speed and direction. At the latest as the air combat took place in close proximity to the SR 22 and the two PA-200 were in rapid descent and approached the FLOOR, the AC should have terminated the exercise with the term "Knock it off".

Use of a reference point is generally permissible for the communication of traffic information. The BFU is of the opinion that the BRAA format is better suited to communicate risks posed by third-party traffic quicker and more precisely. At the beginning of the training, an alpha check was not performed. That means it was not ensured that traffic information using the reference point was even correct. But since the flight crews did not understand the only traffic information prior to the airprox this is not relevant.

Aircraft Controller Assistant

The ACA was a very experienced aircraft controller, trainer and examiner. His voiced opinion resulted in the AC discarding her original plan of lateral separation and

decreased the FLOOR from FL 120 to FL 110. Therefore, important safety barriers were lost. As ACA it was not his place to influence such decisions.

Fighter Allocator

The FA realised the impending conflict situation. He acted too late and insufficiently. The recommendation to raise the FLOOR to FL 120 was given shortly before of at the time of the airprox, respectively. A timely instruction to the AC to “Knock it off” would have been possible and necessary.

Langen Radar

Radar Controller

The responsible radar controller guided the SR 22 at FL 100 through the TRA. Since this had been coordinated with the CRC, he assumed correctly that the CRC was responsible for the separation. He realised the airprox only when the SR 22 pilot reported it. Due to the fast vertical movements during BFM it is understandable that the controller did not realise the conflict situation sooner. However, prior to the airprox, the two PA-200 were in the immediate vicinity of the SR 22 and the controller knew that air combat training was conducted. A traffic information regarding the training military traffic above might have improved the situational awareness of the SR 22 pilot and he might have recognised the impending airprox sooner.

Planning Controller

The planning controller had coordinated the crossing of the TRA by the SR 22 with the CRC beforehand. With the clearance, the CRC was responsible for the separation.

Weather

There were no indications that weather conditions impaired visibility within the TRA.

Organisational Influence

Clearance of Third-Party Traffic through Training Airspace used by the Military

ATC and the CRC had coordinated the crossing of the TRA by civilian traffic. The TRA users were not asked to agree. Since the change in procedures in 2020, agreement of

the training flight crews was no longer required. Obtaining consent could have contributed to all persons involved having a corresponding image of the traffic situation. The change of procedures should be reviewed again. In general, no other traffic should be in a used military training airspace. Is this the case, adequate separation is imperative. During air combat training, lateral separation is absolutely preferable.

Conclusions

The incident was caused by:

- The flight crews involved realised the impending conflict risk too late to prevent the airprox in time.
- The PA-200 undershot the stipulated minimum altitude.
- The CRC personnel reacted too late and insufficiently to the impending conflict situation.

Contributing Factors

- Clearance by the CRC of third-party traffic through a used training airspace without prior coordination with the military users.
- Insufficient separation between military training traffic and third-party traffic.
- Non-authorised personnel influenced the decision-making process.

Investigator in charge: Blanke

Assistance: Schubert

Braunschweig, 22 May 2023

This investigation was conducted in accordance with the regulation (EU) No. 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and the Federal German Law relating to the investigation of accidents and incidents associated with the operation of civil aircraft (*Flugunfall-Untersuchungs-Gesetz - FIUUG*) of 26 August 1998.

The sole objective of the investigation is to prevent future accidents and incidents. The investigation does not seek to ascertain blame or apportion legal liability for any claims that may arise.

This document is a translation of the German Investigation Report. Although every effort was made for the translation to be accurate, in the event of any discrepancies the original German document is the authentic version.

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