

Investigation Report

Identification

Type of Occurrence:	Accident
Date:	10 April 2009
Location:	Schmoldow Special Airfield
Aircraft:	Airplane
Manufacturer / Model:	PZL-104 „Wilga 35"
Injuries to Persons:	Both pilots fatally injured
Damage:	Aircraft destroyed
Other Damage:	None
Information Source:	Investigation by BFU
State File Number:	BFU 3X020-09

Factual Information

History of the Flight

The airplane took off at Schmoldow Special Airfield at 1054 hrs¹ for training flights around the airfield. On board were the pilot and another pilot of the flight club. Six flights with flight times of four to fourteen minutes were conducted. Take-offs occurred on runway 15. During the flights simulated forced landings with simulated

¹ All times local, unless otherwise stated.

engine failure in 2,000 ft² were trained several times. At 1143 hrs the airplane took off once more. Witnesses stated that prior to take-off the pilot had announced via radio the training of another emergency procedure. Several witnesses stated they had noticed the drop of engine noise and the transition into descent in an altitude of 35 to 45 m. The subsequent course of the flight was described differently ("steep descent", "30° downward", "normal descent", "tilting forward"). Then the airplane crashed about 500 m after the beginning of the runway. The airplane flipped over.

Personnel Information

The 52-year-old pilot was a German citizen. He held a Commercial Pilot's Licence (CPL(A)) initially issued on 21 July 2008 in accordance with JAR-FCL German. The licence listed the class rating for Single Engine Piston aeroplane land (SEP (land), PIC, IR, CRI) and Touring Motor Gliders (TMG, PIC, CRI). The rating was valid until 9 February 2011. The licence also listed the ratings for aerobatics with aeroplanes (KFB-A) and aerotowing (SB-(A)). He had a Class 1 Medical Certificate valid until 11 July 2009 issued in accordance with JAR-FCL 3 German. He also held licences for gliders and aerial sports equipment with the ratings for parachutes, gliders and aerodynamically controlled microlight aircraft. The pilot's PPL(A) and glider pilot's licence listed a Flight Instructor (FI) rating. He had a total of approximately 2,500 hours of flying experience on gliders.

His flying experience on aeroplanes:

Total flight time:	546 hours
In the last 90 days:	4:08 hours
In the last 30 days:	4:08 hours
Total flight cycles:	1,313
In the last 90 days:	3
In the last 30 days:	3
Flight time on the type between 2001 and 2008:	22:44 hours
Landings on the type between 2001 and 2008:	88

² All altitudes are Above Ground Level (AGL), unless otherwise stated.

The on-type flight time and number of take-offs during the last years:

Year	2001	2002	2003	2004	2005	2006	2007	2008
Take-offs	38	14	6	3	10	5	11	1
Flight Time	12:36	03:28	00:42	00:50	01:10	01:05	01:59	00:54

Professionally he had been in a responsible position concerning flight safety aspects in general aviation. In the past he had completed 18 type familiarisation trainings.

On 3 February 2009 he had completed a proficiency check for the type rating renewal single engine piston land PIC and IR in a Cessna 172. The check pilot stated that during the first take-off an emergency landing procedure in about 80 ft AGL was trained. During which the pilot slightly over-corrected with stick forward motion. During two more emergency landing exercises in initial climb the stick forward motion was executed correctly. After the landing they talked about the differences of individual airplanes in regard to the stick forward motion after engine failure, among other things. The pilot mentioned the PZL 104 "Wilga 35" as example, especially during aerotow.

The second pilot on board was due to a regulation of the flight club. It required that a certain number of take-offs within a certain time period are conducted in order to fly the airplane PZL-104 "Wilga". If this requirement is not met "these take-offs can be substituted by five so-called "check flights" with "safety pilots"³ the flight club management defined".

The 45-year-old second occupant, who functioned as "safety pilot", held a private pilot's licence initially issued on 6 May 1983. The licence listed the class rating for Single Engine Piston (SEP (land), PIC). The rating was valid until 3 December 2009. It also listed the aerotowing rating (SB(A)). He had a Class 2 Medical Certificate valid until 3 December 2009 issued in accordance with JAR-FCL 3 German. He also held licences for gliders and Touring Motor Gliders (TMG) and the rating as Flight Instructor (FI).

The airplane owner stated, the second occupant had a total flying experience of 1,100 hours, approximately 450 hours of which on PZL-104 "Wilga 35".

³ In this report the term safety pilot is put in quotation marks if it is not used in terms of legal definition.

Aircraft Information

Aircraft Manufacturer:	Panstwowe Zaklady Lotnicze (PZL)
Type:	PZL-104 „Wilga 35“
Manufacturer's Serial Number (MSN):	61 115
Year of manufacture:	1971
Maximum Take-Off Mass:	1,300 kg
Total Airframe Time:	2,400 hours, 31 minutes
Since the last inspection:	4:31 hours
Since the last maintenance:	05:01 hours
Engine type:	AI 14 RA

The last Airworthiness Review Certificate was issued on 7 March 2009. The last weighing occurred on 2 June 2008.

The PZL-104 is a single-engine, high wing airplane in all-metal construction with four seats. The airplane is equipped with a fixed tricycle landing gear with tail wheel and is primarily used for glider towing. It has Short-Take-Off-and-Landing (STOL) attributes.

The European Aviation Safety Agency (EASA) issued the Type Certificate Data Sheet (TCDS) EASA.A.061 for this airplane. It stated the "Fight Manual for PZL-104 Wilga 35A aircraft valid for a/c S/N 48031-74217" as being the valid flight manual.

In the airplane a Flight Handbook (FHB) with the label "Luftfahrzeughandbuch für das Flugzeug PZL-104 Wilga 35A" was found.

It included a procedure for the control of the airplane during engine failure in the take-off phase:

3.3. Engine Failure

1. By engine failure during take-off or landing one must:

a/ up to 100 m altitude land straight ahead and thereby avoid a head-on collision with obstacles;

b/ over 100 m altitude try landing on an emergency landing site.

The manufacturer of the PZL in his function as type certificate holder stated that if an engine failure is trained in this altitude the destruction of the airplane would have to be expected. It would be similar to training aerobatics which is prohibited. It would not be necessary to reach normal landing speed. On the other hand the procedures in accordance with the Airplane Flight Manual (AFM) 3.3.1. (a) had to be applied:

3.3 Engine failure:

1. In case of engine failure during take-off and after take-off, proceed as follows:

a/ up to 100 m altitude, land straight ahead, avoiding head-on collision with obstacles;

b/ over 100 m altitude, make an attempt to land on the airfield if possible.

The manufacturer did not say anything about a possible loss of altitude after an engine failure.

The Polish accident investigation authority estimates that it is not possible to conduct an engine failure exercise in an altitude of 40 m.

The BFU also had the instruction with the title "Flugfibel für das Flugzeug PZL-104 Wilga 35, Ausgabe 1985" (flight book for the airplane PZL-104 Wilga 35, edition 1985) issued by the Gesellschaft für Sport und Technik (GST) (the former organisation for sports and technology). It also describes engine failure during the take-off phase:

By engine failure after take-off up until 25 m altitude landing is to be conducted in take-off direction. Avoidance of obstacles by use of the rudder.

The flare has to occur in 5 - 8 m altitude. During engine failure below the mentioned flare altitude, the control column must be pulled immediately.

Pilots of the former GST stated that an altitude of approximately 1,000 ft was needed during engine failure exercises in order to conduct a 180° turn and then land. Generally the training was conducted by flying a 360° circle beginning in approximately 2,000 ft.

Witnesses stated that the flight idle is about 1,000 min⁻¹.

The airplane was not equipped with shoulder belts. The aircraft owner stated that the aircraft manufacturer did not require the fitting of shoulder belts.

Meteorological Information

The Flugleiter (A person required by German regulation at uncontrolled aerodromes to provide aerodrome information service to pilots) at Schmoldow Special Airfield recorded the following information: Wind from 090° with 6 m/s, clouds 0/8.

The aviation routine weather report (METAR) of Neubrandenburg Airport close by read: METAR ETNU 101020Z 11013KT 9999 16/05 Q1017 BLU+=

Radio Communications

There were radio communications between the airplane and the Flugleiter. The Flugleiter stated that during the previous take-offs the training had been announced by: "D-****, 2,000 ft Ziellandeübung" (call sign, 2,000 ft simulated forced landing exercise). He stated that during the last flight the radio message read "startbereit, Notfallübung" (ready for take-off, emergency exercise). Another witness stated to have heard: "D-****, abflugbereit, Training Übung Notverfahren" (call sign, ready for take-off, training exercise emergency procedure). Both witnesses stated that the pilot had conducted radio communications.

Aerodrome Information

Schmoldow is a special airfield. Aerodrome elevation is 105 ft. It has one grass strip oriented 15/33 which is 900 m long.

The German Language Publication for Aviation NfL I-72/83 stipulated the rescue equipment for airports. The permit documentation stipulated the rescue equipment in accordance with the NfL I-72/83.

Flight Recorder s

A GPS Garmin 55 was on board. It does not store any flight data. Analysable radar data was not available.

Wreckage and Impact Information

The accident site was approximately 4.5 km beyond the threshold of runway 15. The airplane was found in an inverted position. The airplane fuselage pointed in the direction of about 330°. Two parallel traces in the ground were found in flight

direction 46.20 m from the wreckage (Appendix 1, Image 3, Trace A). These traces were approximately 4 m long. The lateral distance roughly equalled the width of the main landing gear. Two additional parallel traces were found in a distance of 43.20 m to 41.70 m (Appendix 1, Image 3, Trace B). These had torn open the sod and each was located about 30 cm within the two other traces described above. In two areas propeller traces were found in the sod.

Area 1	43.2	42.8	42.2	40.4	39.7	39.0	38.3	37.6	
Area 2	19.6	18.8	18.0	17.2	16.4	15.5	14.4	11.0	7.0

(Distance to the main wreckage in metres)

The trace with a distance of 18 m was 10 cm deep and therefore more distinct than the others. The trace with a distance of 7 m was inside a larger heap of earth which was in the middle of the assumed moving direction (Appendix 1, Image 4).

The fuselage had fractured between the engine compartment and the cabin. The engine including the firewall had been bent backward and was lying on the fuselage pointing toward the tail. The propeller spinner and the two main landing gear struts showed traces of earth. The main landing gear had been bent backward. The left strut was about parallel to the longitudinal axis. The right strut almost reached the underside of the flap. The cabin had been compressed by about a third. During the recovery work the engine, the firewall, and the main landing gear were put back in their original positions.

The elevator and the aileron had been severed in the area of the fuselage. The rods showed characteristic signs of forced ruptures. The rods between the control column and the fracture surface and between the fracture surface and the rudder could be moved freely. One control stick was severed during the recovery work and the other showed traces of forced rupture. Pictures taken prior to recovery of the occupants show that the flaps were in an extended position. After the pilots had been recovered the flaps were found retracted. The two right engine levers were in the same position approximately one fourth to the front. The left levers were in different positions approximately in the middle of the setting range. The trim was in normal position. The two seat belts had been severed during the recovery work.

Medical and Pathological Information

The body of the pilot was subject to post mortem examinations. It was determined that the cause of death was compression of the ribcage and bleeding into the spinal canal. There was no impairment by alcohol.

The second occupant was severely injured and resuscitated at the accident site. He died at the hospital five days later. He was not subject to post mortem examinations. Information in regard to cause of death was not compiled.

Fire

There were no signs of fire.

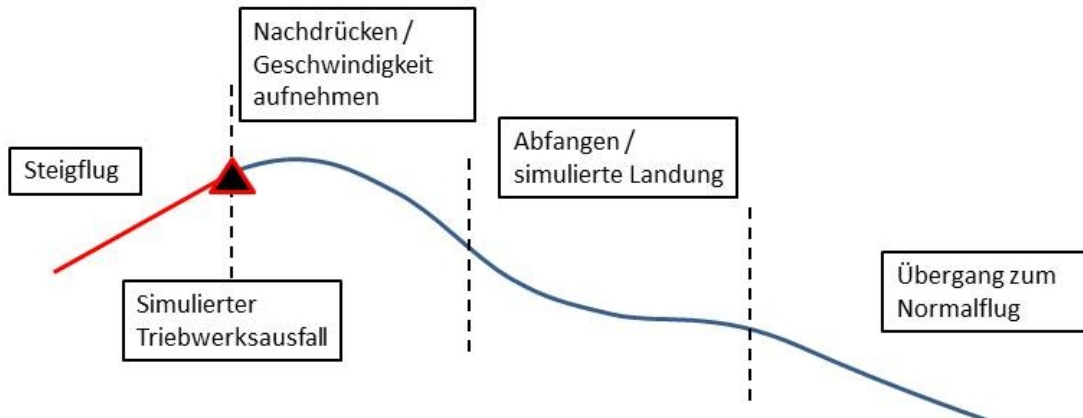
Survival Aspects

The mission report of the Freiwillige Feuerwehr der Gemeinde Bandelin (voluntary fire brigade of the township Bandelin) showed that the emergency call came in at 1150 hrs. At 1155 hrs the fire brigade left the station and reached the accident site at 1200 hrs. Among other things, the fire brigade used jacks, hydraulic spreader and shears. Twenty-one members of the fire brigade were involved.

Flight club members had taken pictures and they show that it took about nine minutes to tip the engine from the cabin. Other photos show the work of the rescue personnel and simultaneous recovery of the occupants. After 12 minutes the person in the right-hand seat had been rescued. After 15 minutes the pilot had been recovered.

Tests and Research

Together with Messwerk GmbH, Braunschweig, the BFU conducted two in-flight tests in September 2013 to determine the behaviour of the PZL-104 "Wilga 35" during simulated engine failure. The aim was to find out whether it is possible to successfully conduct an emergency landing after engine failure in low altitudes with this aircraft type. The airplane had been fitted with sensors which would record the static and dynamic pressures, the acceleration of the z-axis, the GPS data, the positions of the elevator and the power levers. The flight profile for the in-flight tests was as follows:



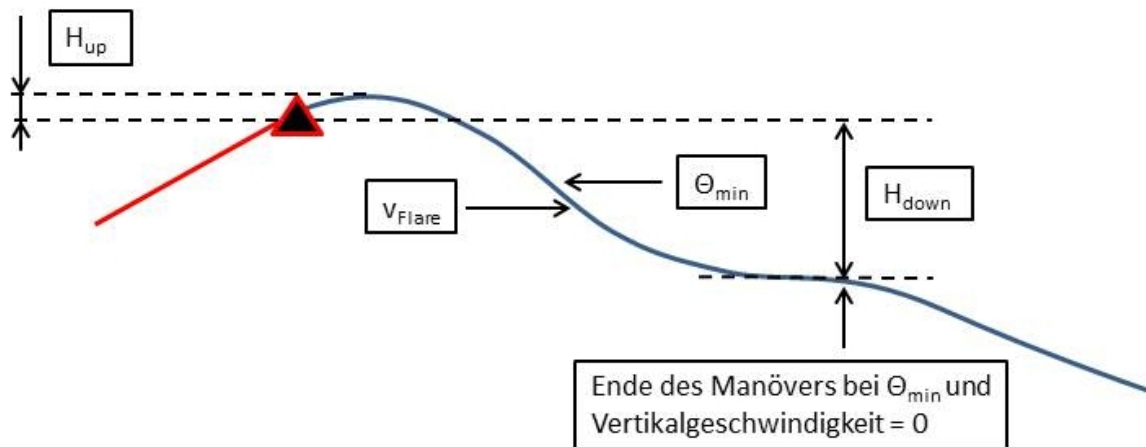
Planned flight profile

Source: BFU / Fa. Messwerk GmbH

The conditions were as follows:

- Airspeed: 115 km/h
- Flaps: 21° (0° during two flights)
- Engine thrust: 2,350 min⁻¹, maximum thrust
- Simulation of the engine failure: reduce power lever

Two pilots conducted a total of 17 tests. The stick forward motion was carried out with a delay of about one second or immediately and strongly. During two tests the pilots did not carry out a stick forward motion at all, but watched for the airplane to recover speed on its own.



Measured values

Source: Fa. Messwerk GmbH / BFU

Appendix 3 shows the graph of one such flight. Analysis of the results showed that the loss of altitude H_{down} mainly depends on the speed reached right before the flare. A stronger input in the first phase does not necessarily result in higher speeds but often leads to smaller pitch angles (steeper nose down) (lesser Θ_{min})⁴ at roughly the same height and speed.

During the flare phase, larger pitch angles (lesser Θ_{min}) resulted in prolonged flare phases with corresponding higher loss of altitude. More time was required to recover the airplane from the larger pitch angle. In addition, larger pitch angles resulted in higher sink rates which led to additional loss of altitude.

Only in a few tests, stronger stick forward motion resulted in higher maximum speed in combination with increased loss of altitude. In two tests this could be largely compensated by stronger flare (n_z about 2 g). Compared to normal control input the loss of altitude was about 10 m higher.

During the tests with a vertical acceleration of n_z about 0.3 to 0.5 g the lowest loss of altitude was recorded.

The analysis showed that the mean loss of altitude was 40 m between the initiation of the simulated engine failure and the simulated landing. Depending on the pitch angle the loss of altitude changed significantly. Under favourable conditions the loss was 24 m and under the most unfavourable 115 m.

⁴ A negative algebraic sign is used for the nose-down pitch angle Θ (Theta).

Additional Information

According to the Gesetz über den Rettungsdienst für das Land Mecklenburg-Vorpommern (law relating to rescue services for the federal state Mecklenburg-Vorpommern), the response time (time between the emergency call and the arrival at a road accident site) should be 10 min.

The term safety pilot is listed in JAR-FCL 3.035 f, in para 4 subpara 6 c (Operational Safety Pilot Limitation – OSL). In addition an information sheet for safety pilots was compiled (1. DV LuftVZO, Anlage 13; 1. Executive Order of the Regulation on Certification and Licensing in Aviation Appendix 13).

Analysis

General

The pilot held a valid licence. The airplane did not have any technical defects, which caused the accident. Weight and balance were within prescribed limits if a mass of 90 kg is assumed for each occupant. The weather conditions were suited to safely conduct the flights.

Course of the Flight and Accident

On this day the pilot had the intention to train emergency procedures. He already had conducted simulated engine failures in higher altitudes. During the subsequent flight he wanted to conduct an emergency procedure as well. He had announced this prior to take-off. Even though there is no information which kind of emergency procedure had been planned during this flight, it can be deduced that the loss of engine power during the initial climb had been planned and initiated by the pilot. There was no evidence of an engine failure. Up until the loss of power no witness had observed any unusual engine noises. In addition, the numerous, evenly distributed propeller traces found up to the final position of the airplane show that there were no technical problems with the engine.

Subsequently the airplane began to dive. Because the witness' statements are not congruent, it is not possible to come to a clear conclusion as to how steep the flight path angle had been. The majority, however, stated that the angle had been rather steep which allows for the conclusion that the pilot over-corrected heavily. The subsequent flare could not be finished completely. The traces in the ground give

information as to the pitch angle during impact. The first parallel traces (Appendix 1, Image 3, No A) correlate with the wheels of the main landing gear. In the extension of the point of impact no propeller traces were found. Therefore, in this phase the pitch angle of the airplane was approximately 8° . The traces located further inward and which are closer together, correlate with the landing gear struts (Appendix 1, Image 3, No B). This shows that the landing gear was heavily pushed inside the earth. From the initial propeller traces (distance 43.2 m to the main wreckage) it can be deduced that the airplane had a pitch angle of 25° (Appendix 2, Image 2). Since no other traces were found on the ground in the direction of the wreckage on a length of 18 m, it can be concluded that the airplane had lifted off again for a short time. In a distance of 19.6 m to the wreckage, the traces on the ground indicate another impact of the airplane. The deep trace in the ground in the immediate vicinity of the wreckage was caused by the propeller spinner which bore into the ground and then the airplane flipped over. It can be concluded that beginning with the initial ground contact until the spinner bore into the ground, the airplane had a negative pitch angle (nose down) which could not be recovered by active counter-steering.

From the described course of the flight it can be deduced that the airplane was not flared completely. The relatively high energy during impact, which caused the main landing gear to sink into the ground up to the landing gear wing, indicates a high sink rate. The distances between the individual propeller traces show that the horizontal velocity was not very high. Even if a propeller RPM of $1,300 \text{ min}^{-1}$ is assumed, the speed is only about 62 km/h.

The estimated pitch angle does not have to match the flight path angle. Therefore the airspeed cannot be estimated.

Since the pilot generally had the qualification to conduct a landing correctly, the accident allows for two possible scenarios:

1. After the reduction of engine power the forward stick movement was strong. The altitude was not sufficient to complete the flare and obtain the pitch angle for the landing. The airplane had sufficient speed but the pitch angle was still too large for a safe touch-down.
2. The flare was begun too soon and/or stronger at a lower airspeed. The pitch angle was reduced further than described in Item 1 in order to reach the pitch angle required for the landing. A stall was the result which then led to the high sink rate during the impact.

Based on the information available it cannot be determined with certainty which of the two scenarios caused the accident. It is highly likely, however, that the first scenario occurred. This is supported by the high energy in flight direction which resulted in the jumping of the airplane over a length of about 43 m after the first massive ground contact. The energy was still high enough that when the propeller hub impacted the ground, the airplane flipped over, and the engine carrier came to rest on top of the airplane. Furthermore, the majority of the witnesses speak of a high pitch angle after the engine power was reduced. Had the airplane impacted with high energy in three-point position (as described in bullet 2, above), traces of the tail wheel on the ground would have been the result. No such traces were found.

To complete the investigation of the accident it was necessary to determine whether the aircraft type can be landed safely after the reduction of engine power or engine failure in low altitude (See: Test and Research and Aircraft Type Characteristics and Aircraft Flight Manual).

Aircraft Type Characteristics and Aircraft Flight Manual

The results of the in-flight tests conducted during the investigation showed that the mean loss of altitude between initiation of the simulated engine failure and the landing was approximately 40 m. But there is also a variance between 115 to 24 m. Especially if the forward stick motion is stronger and the pitch angle increased the loss of altitude is greater. On the other hand the airplane lost airspeed if the forward stick motion was not strong enough. With a real engine failure in approximately 40 m the pilot's challenge is the small range available for the forward stick motion (control column track and speed) to safely land the airplane. Otherwise significantly larger losses of altitude are to be expected. This shows that engine failure in such low altitudes cannot be safely trained.

Neither the AFM nor the FHB found in the airplane described any control technique for engine failures, especially in regard to the elevator. The "Flugfibel für das Flugzeug PZL-104 Wilga 35" does give descriptions for engine failures in low altitudes (up to 8 m) but no control techniques. Based on the in-flight tests the BFU has come to the conclusion that a safe landing after engine failure at low altitudes is only possible if specific procedures for the forward stick motion and the required pitch angle are adhered to. These specific procedures depend on the altitude. Therefore, additional descriptions in the FHB and AFM are required for this altitude range where special control techniques are necessary. The experiences of the pilots of the former GST show that the possibility to initiate a return to the airport as the AFM states for

altitudes above 100 m, is a wrong instruction because the turn cannot be safely completed from this altitude.

A note that engine failure in these altitudes shall not be trained is missing. The BFU is of the opinion that it is questionable, why the aircraft manufacturer estimated training engine failure in this altitude would result in the destruction of the airplane but there is no commensurate note in the AFM or the flight handbook.




The BFU does not know whether these flight characteristics apply to other airplanes with similar design (STOL). It can be assumed, however, that similar control techniques after engine failure would have to be applied.

Pilot Actions during Simulated Engine Failure in the Take-Off Phase

It is highly likely that the pilot's forward stick motion after the reduction of the engine power was too strong. This behaviour concurs with his actions during a check flight on a Cessna 172 in January 2009. It is also comparable to the control technique for a glider after winch cable break. The BFU cannot assess conclusively if this background resulted in the adherence of this control technique.




Because of the missing descriptions in the FHB the pilot did not have any options to familiarise himself with the specialities of this airplane during engine failure at low altitudes. This investigation cannot determine whether the pilot was aware of the hazards of a simulated engine failure close to the ground with this airplane. The low flying experience in this aircraft type was a contributory factor for the non-recognition of the hazard potential.

With the ambition to gain benefit for one's own flight safety the emergency training was conducted so close to reality that the safety margin was very low:

Exercise Hazard High		Proximity to Reality High		Safety Margin Low	
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Based on the exercise hazard the safety margin should have been much larger, had the exercise been planned well. This means the exercise should not have been flown close to the ground.

The conjunction between the exercise hazard, the planned safety margin and the resulting possibly reduced proximity to reality is universal and not just applicable to this exercise:

If Exercise Hazard High		Then: Safety Margin Increase		Result: Proximity to Reality Decreased	
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Pilot Qualification and Cooperation with the "Safety Pilot"

Pilot:

The pilot worked in the field of flight safety aspects and therefore knew how to analyse risks and draw conclusions. His total flying experience was sufficient, even though most of his experience was acquired in gliders. This may have led to the strong forward stick motion as it is common during cable break exercises. The flying experience on PZL -104 "Wilga 35" was not very high. Especially during the last few years he had not flown this type very often. On the other hand, he had flown 18 other aircraft types in the past several years. This confirms the disposition to get to know other airplanes and their flight characteristics.

Second Pilot:

The second occupant acting as "safety pilot" had significantly more flying experience on the PZL 104 "Wilga 35". Due to him being a flight instructor for gliders he basically had the experience to take corrective actions in dangerous situations. He was not a flight instructor for aeroplanes. This, too, may have been a reason why the strong forward stick motion was not prevented. Had the pilot taken spontaneous action (reduction of the engine power) a swift reaction of the "safety pilot" might have prevented the accident.

Crew Action:

Since the pilot was more experienced in the evaluation of flight safety problems and the second pilot did not have the knowledge or experience of an aeroplane flight instructor, it is likely that a competence difference existed possibly preventing communication regarding the evaluation of the situation. It could have prevented an active discussion of the crew about the hazards of this exercise.

The pilot had not flown this aircraft type for some time. Flying together with an experienced pilot to counterbalance this deficit is basically the right decision. It was also required by the flight club. The BFU does not have any information whether the two pilots had made any arrangements prior to the flight. It cannot be estimated

whether the exercise had been planned together or whether it was a spontaneous decision of the pilot or the "safety pilot". In all three cases it did not result in conducting the exercise with a larger safety margin. Therefore the resource of an additional pilot was not made use of. A safety barrier could not take effect.

Definition Safety Pilot:

The JAR-FCL 3.035 defines the use of a safety pilot in combination with restricted medical certificates. In this case the transfer of responsibility for the aircraft to the safety pilot is limited to medical emergencies.

Not only the flight club involved has requirements that if shortcomings in flying experience exist the presence of another pilot is mandated. In principle, these stipulations are appropriate. The additional pilot is then sometimes called "Safety Pilot" without another qualification being required. In other cases it must be a flight instructor. But even then the stipulation does not give any information as to the type of flight and the responsibilities. With training, familiarisations, and check flights the responsibilities are clearly stipulated.

The responsibility of the safety pilot (not as defined by JAR-FCL) is neither defined by aviation regulation nor the flight club. He has no legal basis to interfere with the control of the airplane. The presence of the "safety pilot" did not result in him correcting the actions of the PIC during this flight.

The rather vague instruction of the flight club to involve a "safety pilot" when certain requirements were not met shows that the basically correct idea to create additional resources, was not completely implemented. Among other things, descriptions as to the qualification of the safety pilot, the contents of the flights and the evaluation of the results were missing. Had the flights been declared as training flights with flight instructor, the task sharing within the crew would have been clear.

Flight clubs often do not have the knowledge and experience to effectively establish safety mechanisms. A flight club has to consider and assess suitability, practicability, and aviation classification when determining safety mechanisms. For the responsible persons of a flight club this is a complex task which cannot be managed without additional support. This applies especially to glider clubs without aeroplane training capabilities. Contrary to commercial operators, where safety managements systems are required, there are very little instructions and tools available for flight clubs for the compilation and implementation of suitable safety systems.

Survival Aspects

The injuries of the pilot showed that the occupants could have survived the accident, if they could have been rescued quickly. With the means of the airfield operator a more immediate rescue was not possible. In this case, the means required in I-72/83 were not suitable to rescue both occupants. The fire brigade later used hydraulic cutting and spreading equipment which is not required for the airfield and cannot be operated without special training. This kind of rescue mission can usually only be carried out by fire brigades. The fire brigade needed 10 minutes between the alert and the arrival at the accident site. This time was within the prescribed limit for voluntary fire brigades in Mecklenburg/Vorpommern.

Since there is no medical information on the second pilot an evaluation is not possible.

The BFU cannot assess conclusively whether the missing shoulder belts had any influence on the survivability of the accident. If shoulder belts had been used it is very likely that both occupants would have been fixed in a significantly more upright position. The deformed fuselage limited the space in the head area which would probably have resulted in head injuries which would have influenced survivability.

Conclusions

Findings

The airplane impacted with high energy and low horizontal velocity.

Neither the FHB nor the AFM contains any elevator control technique in regard to engine failure in very low altitudes.

Engine failure in low altitudes cannot be trained safely with this aircraft type.

Neither the FHB nor the AFM contains any descriptions that simulated engine failures in low altitudes should not be trained.

The aircraft had a valid Certificate of Airworthiness. The FHB found did not correspond with the AFM mentioned in the data sheet.

The airplane did not have any technical defects which caused the accident. There was no evidence that a technical defect of the airplane caused the engine failure.

The fuel in the tanks was sufficient for the flight.

The pilot held a valid licence and medical certificate. His flying experience on this type was low.

The presence of a second pilot ("safety pilot") did not result in the exercise being conducted with a larger safety margin.

The weather was sufficient for the conduct of the flight and did not have any influence on the accident.

Given the rescue means available at the airfield a more immediate rescue was not possible.

The provisions of the flight club did not sufficiently stipulate the use of a "safety pilot" (not according to JAR-FCL 3.035). The flight club did not have any guidance or further information to regulate the use of a "safety pilot" (not according to JAR-FCL 3.035).

There are very little instructions and tools available for flight clubs for the compilation and implementation of suitable safety systems.

Causes

The accident was caused by the pilot in command deciding to train a simulated engine failure in a very low altitude, even though it is not possible to do so safely with the aircraft type PZL-104 „Wilga 35".

Contributory factor was that the additional resource of a second pilot ("safety pilot") has not prevented the conduct of the exercise.

Another contributory factor was that the FHB and the AFM for the PZL-104 "Wilga 35" did not contain any descriptions regarding the limitations during training and the special control inputs during an engine failure at low altitudes.

Investigator in charge: Karge

Field investigation: Friedemann, Karge

Braunschweig: 01/05/2015

Appendices

1. Accident site
2. Pitch Angle
3. Excerpt from the documentation of the flight club
4. Selected results of the in-flight test of Messwerk GmbH

Appendix 1



Image 1: Wreckage

Photo: BFU



Image 2: Wreckage viewed from the approach direction

Source: BFU

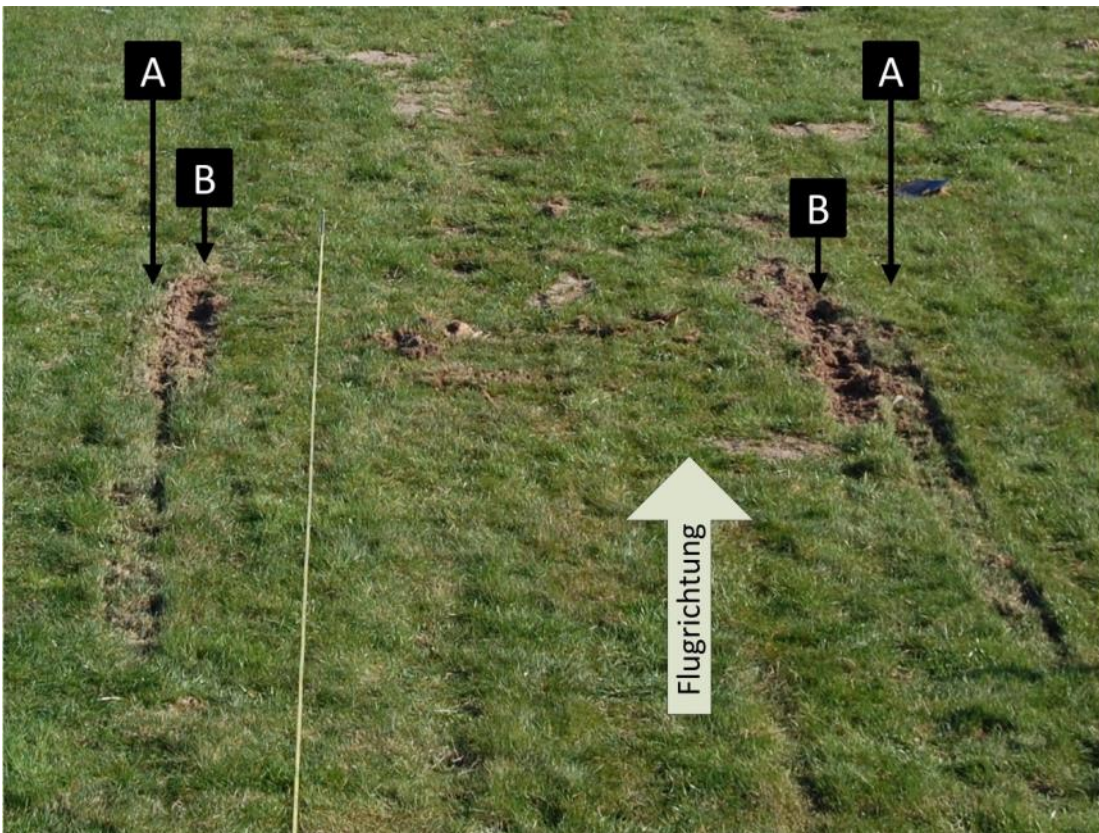


Image 3: Impact traces

Source: BFU



Image 4: Propeller traces and a heap of earth 7 m from the wreckage

Source: BFU

Appendix 2

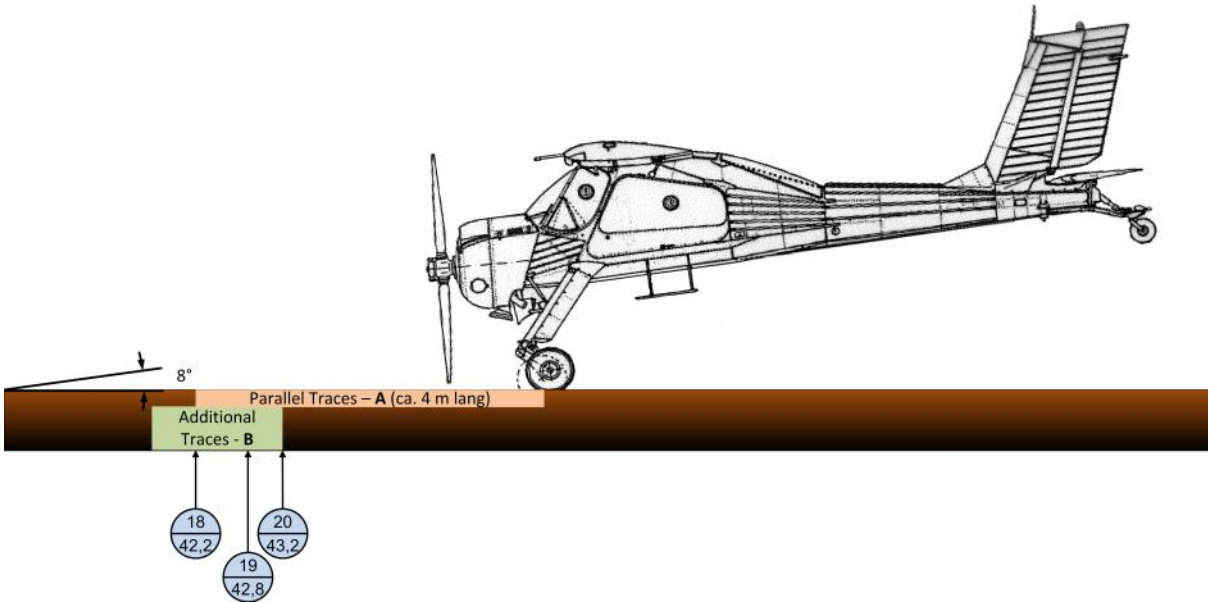


Image 5:

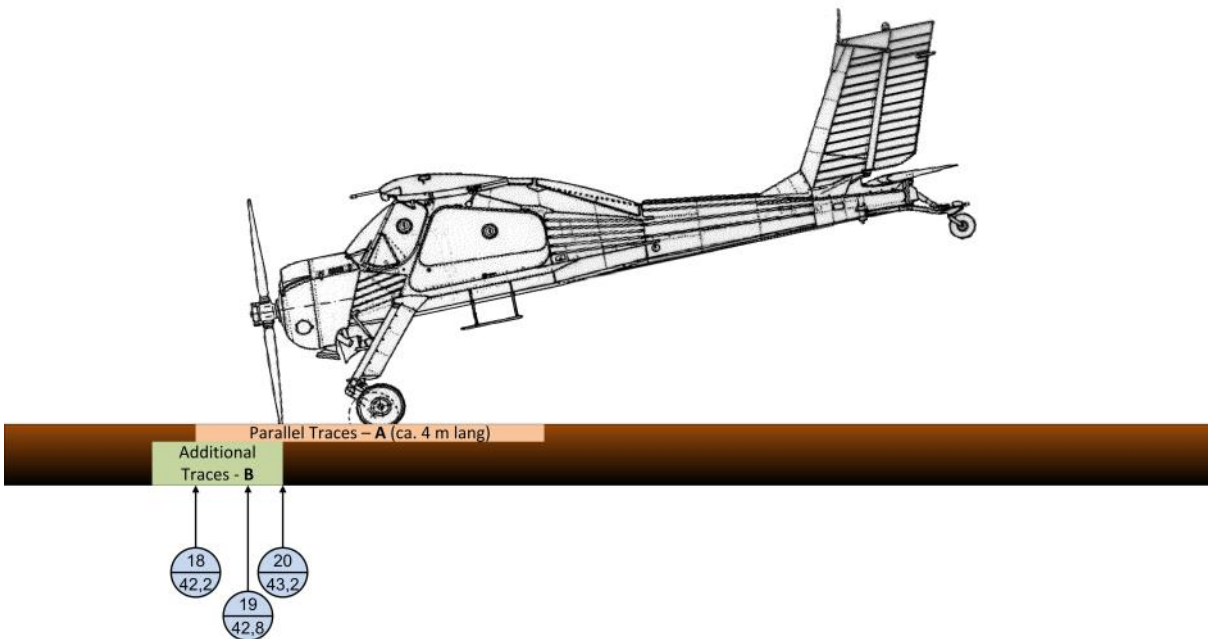


Image 6

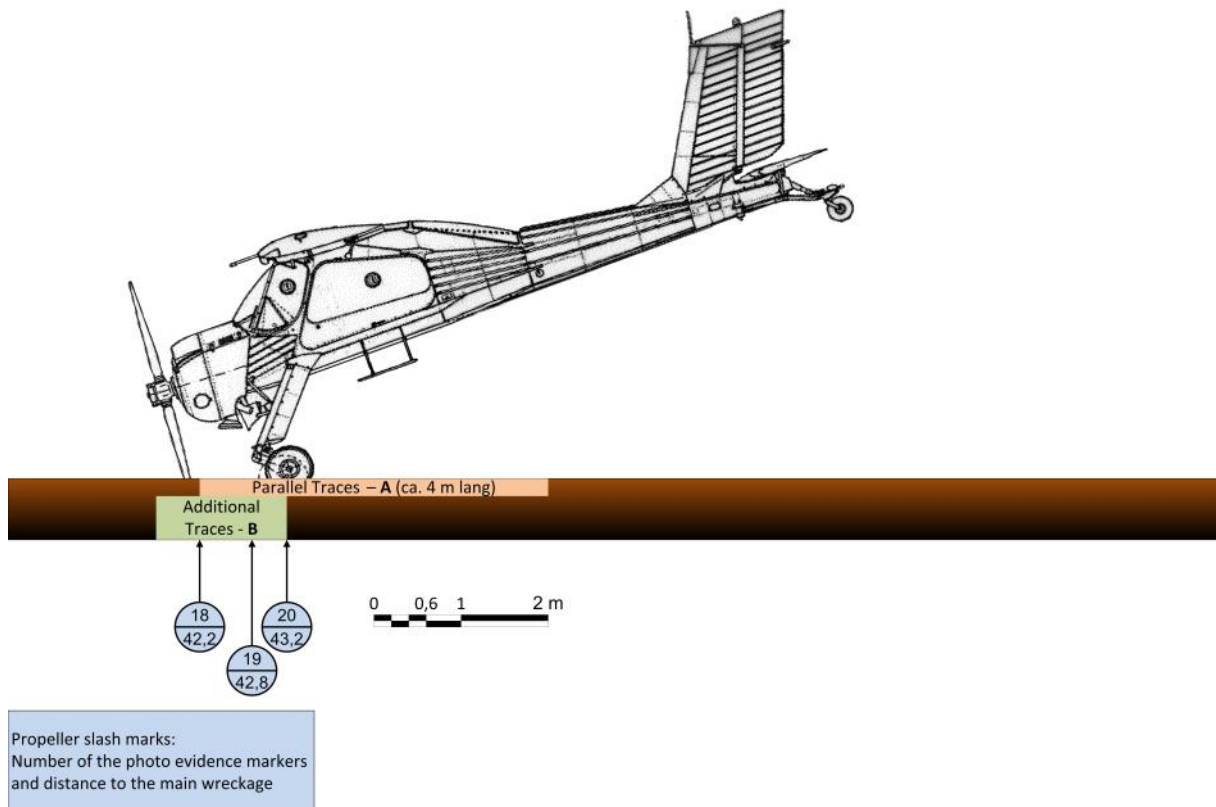


Image 7: Drawing of the pitch angle / impact sequence

Source: BFU

Appendix 3

5.6 Flugbedingungen Wilga

5.6.1 Gültiger Schein mit im Flugbuch eingetragenen Typ- Rating PZL – 104

5.6.2 Innerhalb der letzten 90 Tage 10 Wilga- Starts (in Erweiterung der ohnehin bestehenden gesetzlichen 90 Tage Regelung). Sollte es aus persönlichen, technischen oder meteorologischen Gründen nicht gelingen diese Bedingung zu erfüllen, können diese Starts durch 5 „Checkflüge“ mit vom Vorstand festgelegten Sicherheitspiloten ersetzt werden.

5.6.3 Drei Checkflüge mit einem vom Vorstand benannten Sicherheitspiloten innerhalb des letzten halben Jahres.

Excerpt from the flight club regulations

Source: Flight club

Appendix 4

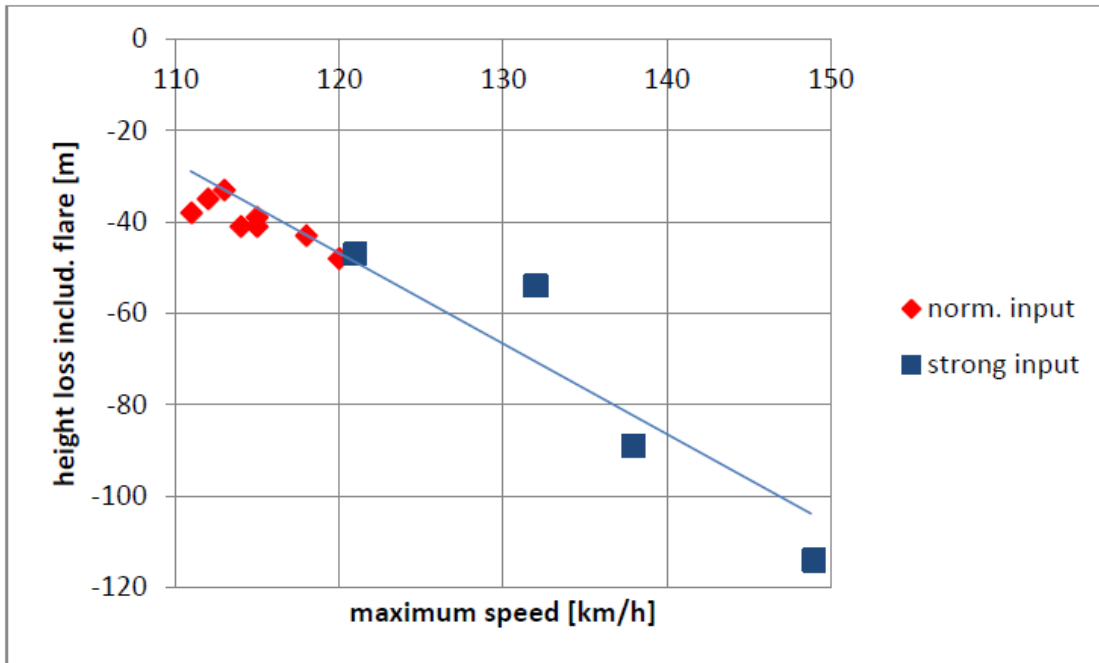


Figure 12: Height loss over maximum speed

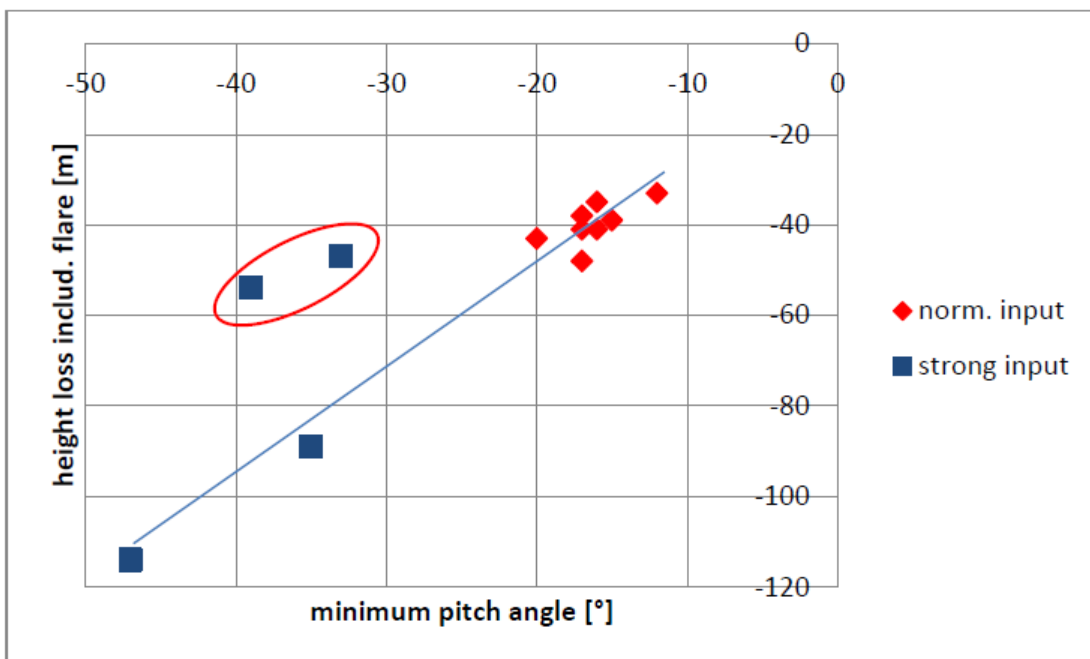
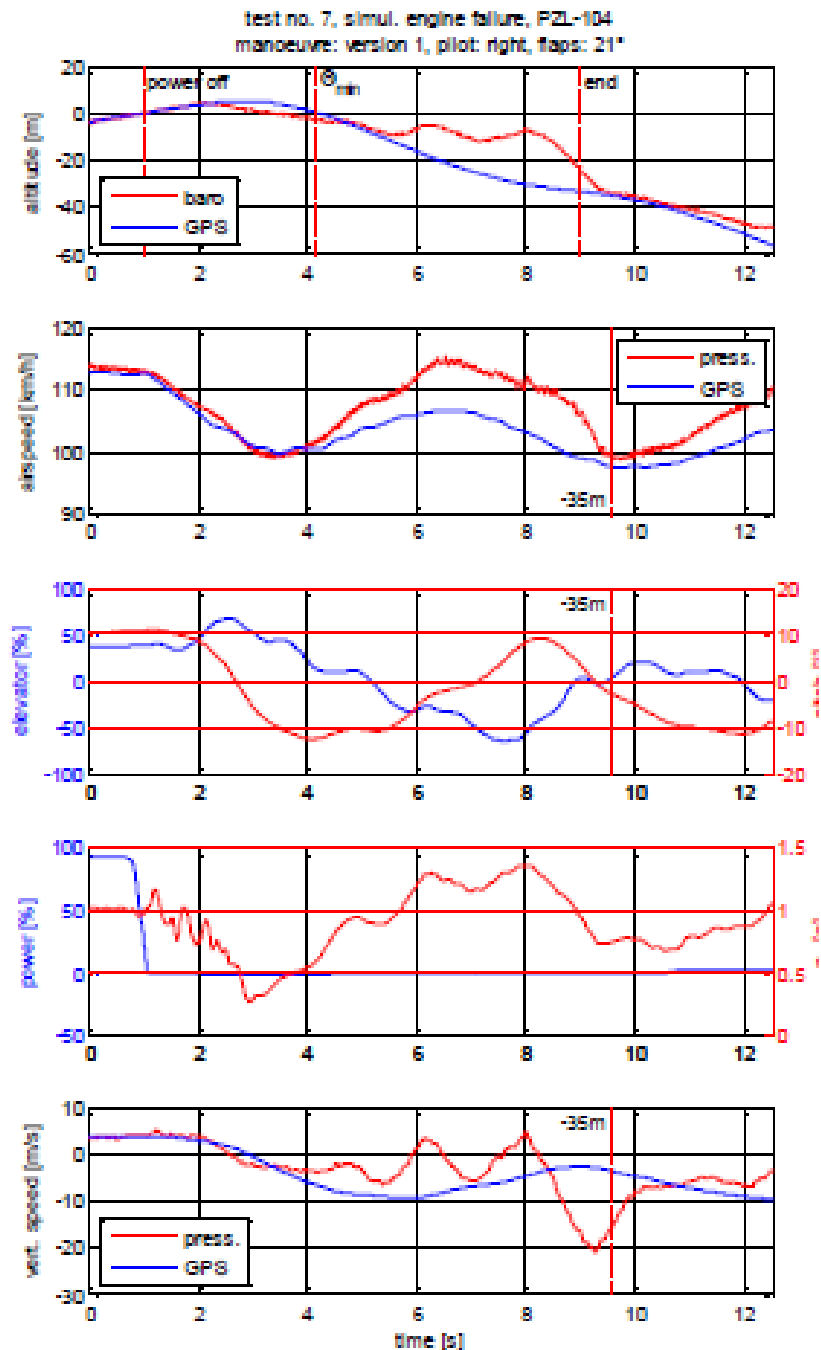


Figure 11: Height loss over minimum pitch angle



Graph of a flight (example)

Source: Messwerk GmbH / BFU

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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