

FINAL REPORT

**Investigation on the accident
to PA-28-181
registration D-EREU
at Brno
on 14 November 2010**

Prague
January 2011

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 report has been translated and published by the Air Accidents Investigation Institute to make its reading easier for English-speaking people. As accurate as the translation may be, the original text in Czech is the work of reference.

Used abbreviations:

AII	Air Accidents Investigation Institute
ACC	Area Control Centre
AGL	Above Ground Level
AIP CR	Aeronautical Information Publication Czech Republic
ALT	Altitude
AMSL	Above mean sea level
ANS	Air Navigation Service
APP	Approach control office
ARC	Airworthiness Review Certificate
ARP	Airport Reference Point
ATC	Air traffic control
ATCO	Air traffic control officer
ATS	Air traffic services
ATIS	Automatic terminal information service
BKD	Brunkendorf (VOR)
BRD	Bundesrepublik Deutschland (Germany)
CAA	Civil Aviation Authority
cm	Centimeter (unit of length)
CTA	Control Area
CTR	Control Zone
°C	Temperature in degrees Celsius
E	East (cardinal direction)
EASA	European Aviation Safety Agency
EDXF	Flensburg Schaferhaus Airfield, SH, (Germany)
ERGOM	Name-code designator for significant point (Hungary)
FIA	Flight Information Assistant
FIC	Flight Information Centre
FID	Flight Information Dispatcher
FIR	Flight Information Region
FL	Flight Level
FPL	Filed Flight Plan
ft	Feet (unit of length - 0,3048 m)
h	Hours
hPa	Hectopascal (unit of Atmospheric pressure)
HDO	Hermsdorf (VOR)
GPS	Global Positioning System
IATCC	Integrated Air Control Traffic Centre
ICAO	International Civil Aviation Organization
IDP	Information Data Processor
km	Kilometre (unit of length)
kt	Knot (unit of speed - 1,852 km.h ⁻¹)
l	litre (unit of volume)
LHTL	Tököl - Public International Aerodrome (Hungary)
LHBP	Budapest - Public International Aerodrome (Hungary)
LKPD	Pardubice - Public International Aerodrome (Czech Republic)
LKTB	Brno/Tuřany - Public International Aerodrome (Czech Republic)
LUB	Lübeck (VOR)

m	Meter (unit of length)
min	Minute (unit of measurement of time)
MAPP	Military Approach Control Unit
MCTR	Military Control Zone
METAR	Aviation routine weather report
MHz	Megahertz (unit of frequency)
MCTR	Military Control Zone
MTMA	Military Terminal Control Area
NE	North-east (cardinal direction)
NIGHT	Night (pilot qualification)
N	North (cardinal direction)
NM	Nautical mile (unit of length)
NW	North-west (cardinal direction)
ODNEM	Name-code designator for significant point (Czech Republic)
PIC	Pilot in command
PPL(A)	Private Pilot Licence (Aeroplane)
QNH	Altimeter sub-scale setting to obtain elevation
RCC	Rescue co-ordination centre
RWY	Runway
S	South (cardinal direction)
SC ACC	Shift supervisor ACC
SE	South-east (cardinal direction)
Sec	Second (unit of time)
SEP land	Singl Engine Piston (Land)
SSR	Secondary Surveillance Radar
STC	Supplemental type certificate
SW	South-west (cardinal direction)
TWR	Aerodromw Control Tower
U.S. gal.	Galon (Volume unit – 3,785 l)
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules
VOR	VHF omnidirectional radio range

A) Introduction

Operator: Aéroclub Du Sud (Reunion) France
Aircraft type: The New Piper Aircraft, Inc., PA-28-181 ARCHER III
Registration: D-EREU
Location of accident: Brno, motorway R43
Date and Time: 14. 11. 2010, 17:08 (All times are UTC)

B) Synopsis

On 14th November 2010, UZPLN was notified of an air accident involving aircraft PA-28-181. Within FIR Prague, the pilot, who was flying VFR following his flight plan from EDXF to LHTL, found out a problem with fuel supply from the right wing, so he decided to land at LKTB. When in position 7 NM NW LKTB, the pilot reported he had a big problem that made him make an emergency landing as the amount of fuel left was not sufficient to land at LKTB. Shortly after that the pilot transmitted a message he was going to crash near Brno since he had run completely out of fuel. He then tried to land on the highway R43. At a height of about one meter above the ground the plane hit with its left wing a public lighting lamp pole while its main undercarriage ran into the crash barrier of the divider strip. The left wing was destroyed, the undercarriage left wheel broke off, the nose landing gear and the propeller were damaged during the crash. On hitting the ground the plane came to halt on the highway right side. Neither the pilot nor the passengers were injured. No people or property near the crash site was afflicted.

Eye witnesses reported the accident to the CR Police and TWR Tuřany fire- and rescue-squad. AAll inspectors came to the accident site on the same day and launched an investigation into the accident causes, assisted by the Police of the Czech Republic.

The cause of the accident was investigated by an AAll commission comprising:

Commission Chairman: Mr. Zdeněk Formánek
Commission Member: Mr. Stanislav Suchý
Mr. Lubomír Střihavka
Mr Milan Zikmund - ANS CR

The Final report was released by:

AIR ACCIDENTS INVESTIGATION INSTITUTE
Beranových 130
199 01 PRAHA 99

31 January 2011.

C) The Final report includes the following main parts:

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

1 Factual information

1.1 History of the flight

The course of the flight was established from the pilot's statement, radio communications between the aircraft and ATS stations, and from the recorded radar data.

1.1.1 Events before critical flight

The aircraft type PA-28-181 had been transported from the third country. The owner had bought the plane from the importer, thereby the latter arranged for airworthiness maintenance tasks to be carried out by an organisation authorized to control them. The organization had checked the airworthiness and issued ARC on 19 October 2010. The Importer had asked for a record to be made in the BRD flight register, which was made on 9 November 2010 under registration mark D-EREU.

Along with the aircraft the owner had also bought an auxiliary fuel tank to increase the plane's range and arranged for its installation into the aircraft. The tank had been mounted in place of rear seats by a maintenance firm which warned the owner repeatedly that a supplemental type certificate was needed for the installation. Since the owner had not delivered STC for the auxiliary tank from EASA, its connection to the fuel system was not part of the work done. For safety reason the maintenance organization had placed a warning sign on the plane and written in the logbook page 2 the same highlighted warning:

Ferry Tank is NOT connected to the Aircraft Fuel System!

The aircrew making the cross country flight to the owner gathered at EDXF on 13 November 2010. Another pilot joined the crew as well. The crew members had taken the plane from the maintenance firm. They found out that the extra fuel tank and the fuel cock had not been connected to the fuel system. So the crew members had decided to connect the extra tank to the fuel system on their own. They did the work themselves without the help of the maintenance organisation that offered just tools and perhaps a scheme of the fuel system.

After the auxiliary fuel tank had been connected, the pilot started the engine to check the fuel system. He first verified fuel supply from the left wing tank, then set the fuel tank selector valve to the right wing fuel tank and checked the supply from the auxiliary tank. He ran checks for more than 10 minutes to make sure there was no water or impurities in the fuel circuit. Total checks on the fuel system had taken 20 minutes.

The crew scheduled the first leg of the flight to the owner on 14 November 2010 as a VFR flight from EDXF to LH TL and filed the following FLP:

FPL-DEREU-VG -P28R/L-S/C -EDXF1230 -N0120VFR LUB BKD HDO ODNEM ERGOM -LH TL0500 LHBP
--

The crew made a pre-flight inspection on 14 November 2010. The pilot said in his statement he had filled the wing tanks with fuel up to 50 U.S. gal. In addition, he had pumped 100 l fuel (26.4 U.S. gal.) into an auxiliary tank in the cockpit.

1.1.2 Critical flight

The pilot started the engine at 12:34 and took off from EDXF at 12:42. The fuel tank selector valve had been switched to the left wing tank. The fuel was pumped till 13:52. At that time the pilot switched the selector valve to the right wing tank so the fuel was coming from the auxiliary tank. According to the radar records, the flight went on without problems till the FIR Praha boundary.

At 15:55, on the surveillance system there was indication of an aircraft entering FIR Praha at the HDO point at flight level 6600 ft with the SSR transponder set to code A7000.

It follows from the analysis of FIC Praha radio communications that the pilot reported at 15:57:10 on the FIC Praha frequency. He sent a message to say he wanted to continue via FIR Praha to Budapest at FL 70. FID issued instruction to set SSR transponder to code A3331, which the pilot confirmed.

At 15:57:53 FID informed the pilot on a regional QNH 1002 hPa. The pilot confirmed the information. The flight went on with heading¹ 130 deg., speed² 110 – 120 kt, FL 70, on track towards the point ODNEM.

The pilot stated that at 16:15, after usable fuel in the auxiliary tank had been consumed, he switched over the auxiliary fuel cock to the right wing tank. About one minute later he found out, from the speed drop and decreased fuel pressure on the indicator that fuel supply from the right wing tank did not work. He switched on the fuel pump but the fuel supply was not resumed any more and the pressure dropped to zero. Therefore the pilot switched over the selector valve to the left wing tank and the fuel supply to engine resumed. The usable amount of fuel in the left wing tank was sufficient for 45 minutes flight, according to the pilot.

At 16:21:46 the pilot transmitted a message: *“Praha information, this is D-EREU. We have problem with transferring our fuel, I think we have to divert to LKTB”*. FID reacted to the message to say there was no problem in his opinion. The flight was in position 62 NM from LKTB. Then the pilot asked FID to confirm that LKTB would be serviceable. FID confirmed that LKTB would surely be on service. At 16:23:09 FID asked EC APP Brno whether he had FPL for D-EREU. Receiving a positive answer he told him that the flight would land in Brno because of a fuel problem and would not fly farther. He did not transfer the part of the message concerning fuel.

At 16:22:33 FID requested the pilot to contact the MAPP LKPD frequency.

At 16:23:31 the pilot established contact with MAPP LKPD and issued information: *“...we are now 20 miles from your airfield and we should divert maybe on your field or LKTB”*. To this MAPP EC responded with a message: *“DEU confirm you are proceeding to LKTB”*. The pilot sent a message: *“Could you confirm please your field is open”*, to which MAPP EC responded: *“Negative sir aerodrome Pardubice is closed for civilian traffic. Now only military traffic.”* Upon which the pilot said straightaway: *“OK, I think we will land at your field LKPD. OK I land in your field.”* MAPP EC repeated again: *“Negative sir negative we are closed. Pardubice is closed. LKPD there is not any possibility to land.”* The airplane was at a distance of 13 NM from LKPD. At 16:24:38 the pilot sent a message: *“OK, could you check if LKTB is open please?”* MAPP EC then checked out that LKTB aerodrome was open and confirmed that information to the pilot: *“D-EREU proceed direct LKTB, this airfield is open.”*

¹ The heading matches of a vector derived from multiradar dates recovered by ATC. All in this way derived headings at description of the flight would have been in view as approximated.

² The airspeed is derived from multiradar dates recovered by ATC. All in this way derived airspeeds at description of the flight would have been in view as approximated groundspeeds.

At 16:26:10 the pilot sent a message: “OK thank you very much. May I have RWY in use and everything please?” MAPP EC found out and gave the pilot information:” RWY in use 10”. The pilot confirmed this information. Then MAPP EC issued information for communication transfer, but again with FIC Praha. According to the radar record, the plane descended to flight level 6500 ft when it entered MTMA Pardubice.

It follows from the FIC Praha radio communication transcript that the pilot re-established contact at 16:35:36 and informed FID “...D-EREU...I am to contact to back, my new contact will be LKTB, estimated in thirty two minutes.” FID confirmed the information. At 16:44:06 FID verified and the pilot confirmed two-way contact. After 53 minutes’ flight in FIR Praha the airplane was 45 NM away from LKTB, see Fig 1.

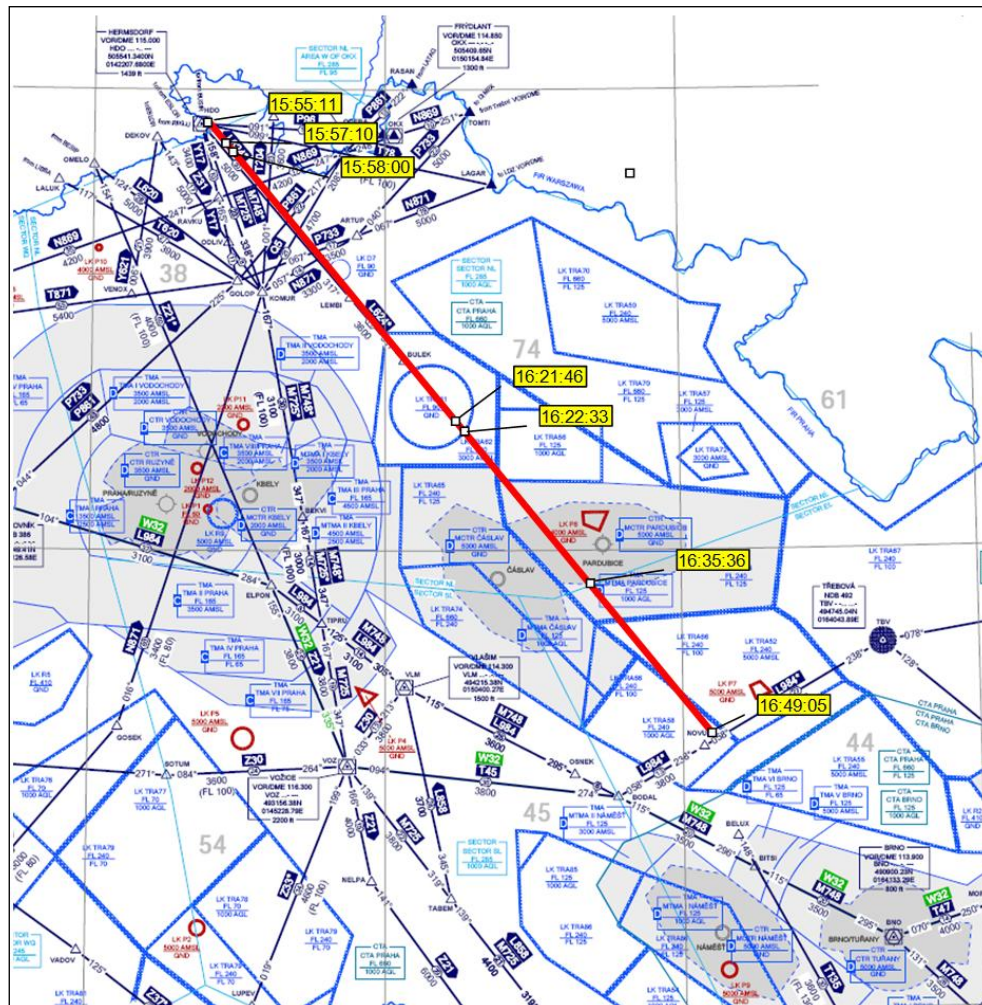


Fig. 1 Flight in FIR Praha

At 16:49:05 FID gave the pilot information to tune in to APP LKTB frequency. The pilot confirmed the information. At that time, the radar transcript showed the distance to LKTB 34 NM, heading 139 deg, and LKTB calculated time was 17:07. It follows from the APP Brno radar communication readout that the pilot established contact:” Brno approach, D-EREU good evening, good night “ and then sent out a message :” OK ... 6500 feet on QNH 1008 it will be for full stop landing...”

APP EC replied with an instruction: “... Roger, proceed to our airport, then report enter point November”. The pilot confirmed the instruction and continued to fly heading for LKTB, and beginning to descend from flight level 6000 ft at an approximate route speed of 110 kt and an average vertical speed of 140 ft/min to 5100 ft AMSL.

At 16:58:14 APP EC issued an instruction to contact TWR Tuřany. The pilot confirmed the instruction and at 16:58:37 he established contact with TWR EC: “Tower this is D-EREU” and to the TWR EC’s instruction *D-EREU Tuřany Tower hallo again continue approach.in sight? ...in sight?* The pilot answered: “Not yet. I am looking your lightings, but I am not sure that I am in sight.” TWR EC informed the pilot he was 16 NM away from LKTB. The plane was flying at level 4800 ft AMSL.

At 17:04:54 the pilot issued a report: “we have big big problem, D-EREU we have big problem, we have emergency landing to do.” Upon which TWR EC replied to him: “You mean now?” The pilot repeated his report and TWR EC, regarding the plane position, sent a report about the airfield Medlanky: “... DEU approximately 1 mile front of you there is VFR field basis, no lights, it is small possibility, If you are able to continue to airport it is approximately 5 miles, 5 minutes ahead of you.”, Fig 2.

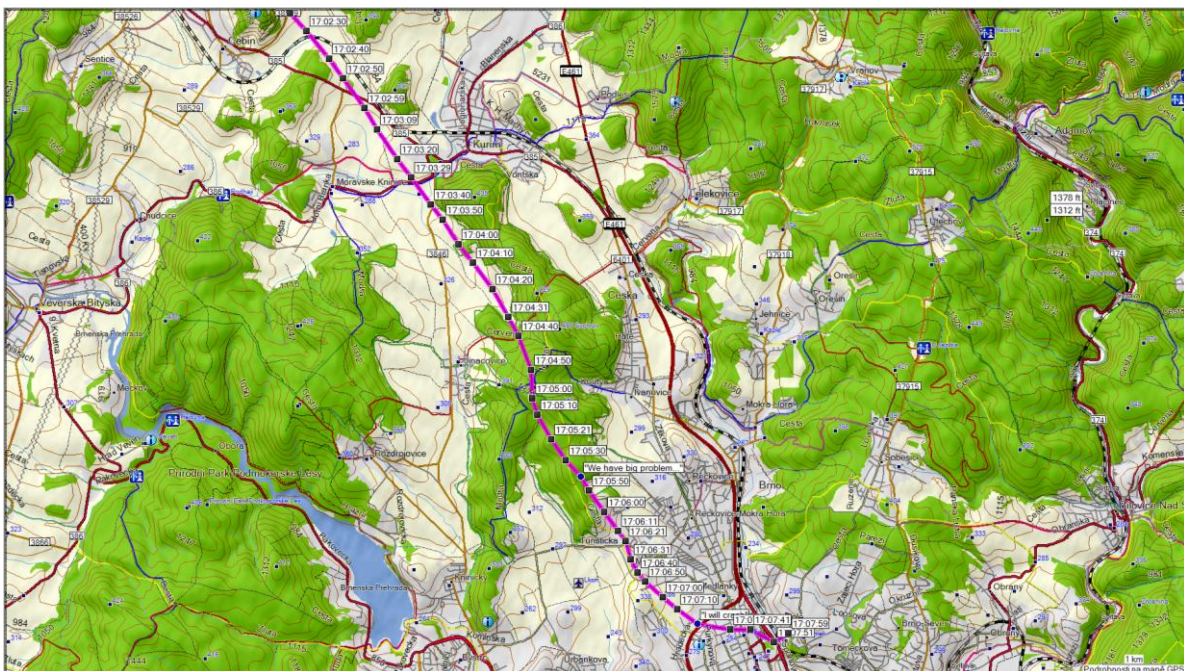


Fig. 2 Flight before emergency landing

The pilot said in his statement that after spending fuel reserve in the left wing tank, he descended for about three to four minutes seeking a convenient landing site. He did not see the Medlanky airfield, having town buildings ahead. After 20 sec. TWR asked the pilot: “DEU able to continue approach to the airport Brno?” The pilot answered: “...Sir, I tried to but we have very big problem because I am liquid my fuel and I have 1 minutes economy but it is at least 7 min to fly, It is not possible to fly so long way.” TWR EC sent out a message: “DEU If is able try to do so it is just 5 minutes ahead of you.” The pilot answered: “I am not sure we can fly 5 minutes, I am not sure.”

At 17:07 the pilot sent a report: “I am 1500 feet, I will crash in few minutes.” TWR EC issued a report: “DEU there is city below you, try to do I am calling firemen.” The pilot answered: “OK I try to land, we ... I am not sure.”

At 17:07:21 on level 1500 ft AMSL the primary indication of radar position of A3331 flight was lost on the surveillance display.

In the critical situation the pilot decided to try to make an emergency landing on the highway R43 situated to his left and lit by public lighting. Turning left he glided to the road direction 358°, but suddenly, seeing a bridge over the road, he reduced descent down to the stall limit to be able to land behind the bridge. At about one meter above the

ground the plane's left wing struck a pole no.171 of the public lighting and the main left undercarriage ran into the crash barrier of the road divider strip. During the crash the left wing was destroyed and the main left undercarriage was damaged. Immediately after the collision the nose of the plane crashed into the ground and the plane turned slightly right towards the road shoulder. Then the plane came to halt on the right-hand side of the road. The pilot and the passengers were not injured.

After the emergency landing the aircraft was at a distance of 13 km SE from ARP LKTB, its position being N 49° 14' 47.3'', E 16° 35' 20.9'', see Fig 3.



Fig. 3 Position of the emergency landing the aircraft PA-28-181 D-EREU

At 17:08:53 TWR EC tried to established contact with D-EREU without success. A radar record showed that the flight symbol A3331 disappeared from the TWR EC surveillance display at 17:09.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	0	0	0
Serious	0	0	0
Minor/None	0/1	0/1	0

1.3 Damage to aircraft

The airplane was seriously damaged due to its crash into the lighting pole and the road barrier and by its nose striking the ground; sees Fig.4. On the left wing, in place where the aileron had been attached, the whole outer part with the aileron was torn off. The wing and fuselage structure was deformed at the roots of left and right wings. The wing / fuselage midsection attachment was damaged and the wing hinges were shifted backward.

The nose was damaged owing to the crash into the road surface after the nose landing gear leg had been broken. One propeller blade was distorted backward, the second blade showed lengthwise grooves.



Fig. 4 Damage of the airplane PA-28-181 D-EREU

1.4 Other damage

Damage on the accident site was not calculated.

1.5 Personnel information

1.5.1 Pilot

Personnel data:

- Male, aged 58 years,
- Private pilot's license (aircraft) PPL(A), valid, issued by CAA France on 23 June 2009,
- Ratings: SEP land, NIGHT, valid
- Medical certificate Class 2, valid to 30 November 2012.

Flying experience:

Total all types according pilot logbook to last record:

- Total all types: 591 hours,
- Total last 90 days: 7 hours 20 minutes,
- Of wich on D-EREU: 4 hours 40 minutes,

1.5.2 Passenger Other person aboard

- Male, aged 60 years,
- Private pilot's license (aircraft) PPL(A)

Flying experience:

Total pilot time on all types according pilot logbook to last record 438 hours.

1.5.3 ATS personnel

The unit for providing flight information service and alerting service to non-controlled VFR flights in classes E and G in Bohemia sector FIR Praha, which on request provides also flight information service to non-controlled flights in CTA Praha, had working positions FID and FIA filled.

Position		FID
Age		59
Day on duty in order		1
Length of duty (hours)	From the beginning of shift (incl. breaks)	8.5 h
	From last duty rota	0.5 h
Experience (years)		5.5
Last refresher training		19 May 2010

The unit for providing air traffic control service at LKTB had working positions TWR EC and APP EC filled.

Position		TWR EC	APP EC
Age		28	53
Day on duty in order		1	
Length of duty (hours)	From the beginning of shift (incl. breaks)	10	10
	From last rota	1	5
Experience (years)		1 (14 months)	5
Last refresher training		28 June 2010	November 2010

1.6 Aircraft information

1.6.1 Basic airplane information

Type:	Piper PA-28-181
Registration:	D-EREU
Manufacturer:	Piper Aircraft Corporation
Year of manufacture:	1996
Serial number:	28-43055
Certificate of airworthiness:	valid
Total flight time:	3 547 hours
Total flight time from last checkup:	4 hours 40 min
Assurance certificate:	valid

The PA-28-181 is a four-seat one-engine all metal low-wing monoplane, one-pilot crew, fixed landing gear and nose undercarriage. It has convention control with mechanical force transition to control surfaces and electro-controlled lift flaps.

Power plant:

Type of engine:	Lycoming O-360-A4M
Manufacturer:	Lycoming
Total flight time:	1 020 hours
Propeller:	Sensenich 76EM8S14-0-62
Total flight time:	1 137 hours

1.6.2 Aircraft fuel system

1.6.2.1 Basic fuel system

The basic fuel system consists of two wing tanks, fuel line, and a fuel tank selector valve to control fuel delivery from tanks. Wing tanks are for 25 U.S. gal. each. They are attached to the leading edge of right and left wings through screws.

1.6.2.2 Fuel system with an auxiliary fuel tank built in

An auxiliary fuel system was mounted on airplane PA-28-181 ARCHER III serial no. 28 43055 before the flight, consisting of an auxiliary tank for 100 U.S. gal., an auxiliary fuel cock, a fuel gauge and a vent pipe. The tank was installed in the flight-deck in place of rear seats. The hand controlled fuel cock was connected to the pipe from the right wing tank. The auxiliary tank vent pipe was led out of the plane with a plastic hose on the left side of cockpit glazing.

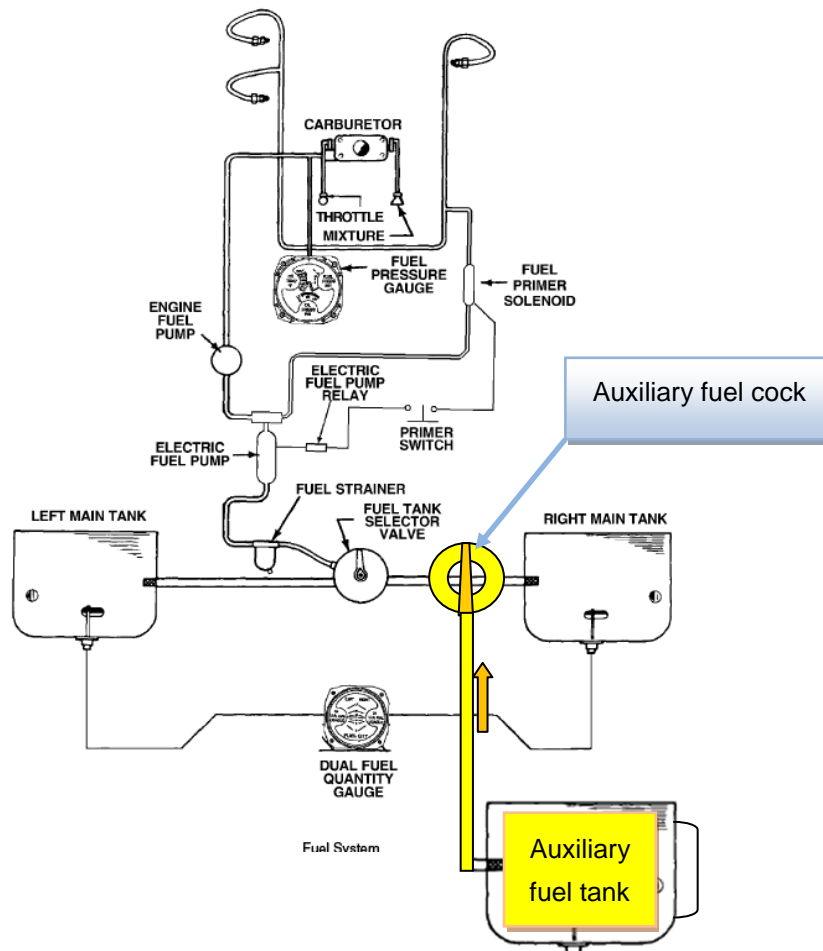


Fig 5 Fuel system with an auxiliary fuel tank built in

The auxiliary fuel cock controlled fuel supply from the extra tank and from the right wing tank. Since the vent system of the right wing tank remained in the original state, the auxiliary fuel cock also prevented the fuel from flowing out through this vent pipe. An amount of 100 l (26.4 U.S.gal) fuel was filled into the extra tank before take off.



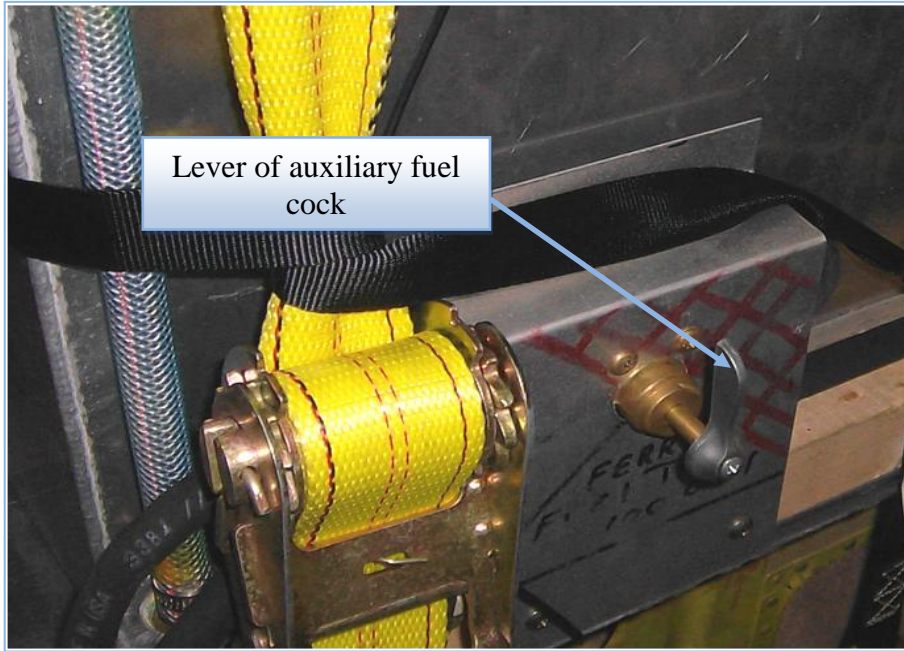
Fig 6. Auxiliary tank and fuel quantity indicator position

Auxiliary fuel system was connected to pipe running from right wing tank to fuel tank selector valve.



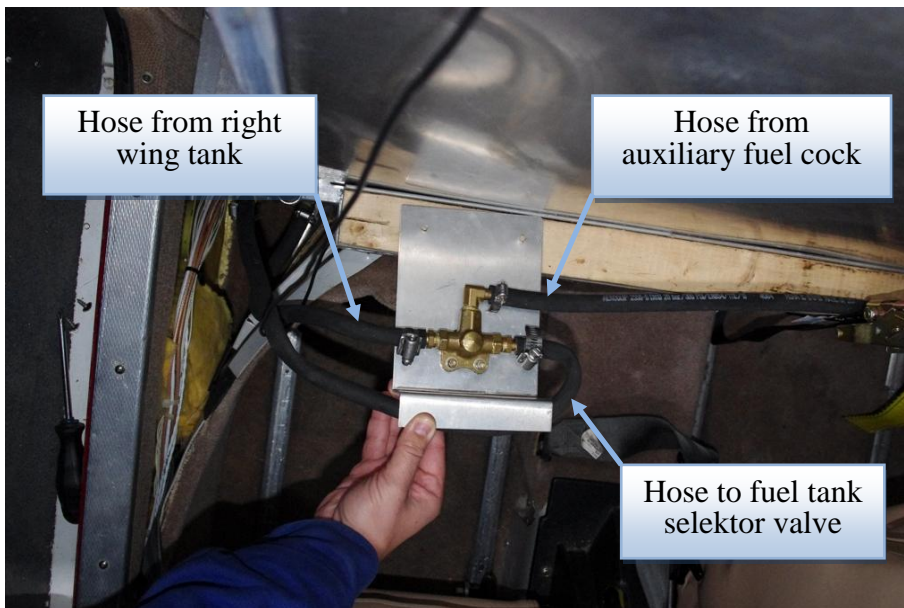
Fig 7. Auxiliary fuel system instalation place

Auxiliary fuel cock was placed down behind the seat back of the right front seat and was accessible to enable handling from pilot's post from the left front seat. The auxiliary fuel cock has three working positions.



Lever of auxiliary fuel cock

Fig. 8. Position of lever auxiliary fuel cock after forced landing 14. 11. 2010.



Hose from right wing tank

Hose from auxiliary fuel cock

Hose to fuel tank selektor valve

Fig. 9. Fastening fuel supply hoses to auxiliary fuel cock

1.7 Meteorological information

1.7.1 Synoptic situation

Very warm and stable S-SW air current flew to the Czech Republic at front side of depression.

1.7.2 ctual situation

Regional QNH at FIR Praha was 1002 hPa. METAR reports from aerodromes Pardubice and Brno Tuřany at 15:00-17:00 UTC:

Meteorological conditions according to METAR LKPD at 16:00-17:00 on 14. 11. 2010:

Time	Wind direction and speed	Visibility	Present weather	Clouds amount and height	Temperature	Dew point	QNH
16:00	120° 8 kt	9999	NOSIG	CAVOK	10°C	8°C	1007 hPa
17:00	110° 3 kt	9999	NOSIG	CAVOK	11°C	9°C	1008 hPa

Meteorological conditions according to METAR LKTB at 16:00-17:00 on 14. 11. 2010:

Time	Wind direction and speed	Visibility	Present weather	Clouds amount and height	Temperature	Dew point	QNH
16:00	120° 8 kt	9999	NOSIG	FEW 023	10°C	9°C	1008 hPa
16:30	130° 5 kt	9999	NOSIG	FEW 023	11°C	9°C	1009 hPa
17:00	110° 5 kt	9999	NOSIG	FEW 023	11°C	9°C	1009 hPa

ATIS Brno Tuřany:

GOOD AFTERNOON TURANY ATIS INFORMATION ROMEO 1630
 VOR DME APPROACH RUNWAY IN USE 10
 TRANSITION LEVEL 60
 METAR TURANY ISSUED AT 16,30
 WIND 130 DEGREES 5 KNOTS VARIABLE BETWEEN 080 AND 160 DEGREES VISIBILITY 10 KILOMETRES OR MORE
 FEW 2 THOUSAND 3 HUNDRED FEET TEMPERATURE 11 DEWPOINT 9 QNH 1009 HECTOPASCALS NOSIG
 YOU HAVE RECEIVED ATIS INFORMATION ROMEO

GOOD AFTERNOON TURANY ATIS INFORMATION KILO 1700
 VOR DME APPROACH RUNWAY IN USE 10
 TRANSITION LEVEL 60
 METAR TURANY ISSUED AT 17,00
 WIND 110 DEGREES 5 KNOTS VARIABLE BETWEEN 080 AND 150 DEGREES VISIBILITY 10 KILOMETRES OR MORE
 FEW 2 THOUSAND 3 HUNDRED FEET TEMPERATURE 11 DEWPOINT 9 QNH 1009 HECTOPASCALS NOSIG
 YOU HAVE RECEIVED ATIS INFORMATION KILO

1.8 Aids to navigation

Radio navigational and visual aids at LKTB conformed to precision approach aerodrome class under ICAO Annex 14.

1.9 Communications

The pilot established radio contact in FIR Praha on frequencies FIC 126.1 MHz, MAPP Pardubice 127.650 MHz, APP Brno 120.550 MHz and TWR Tuřany 119.6 MHz. Communication records include reports transmitted from 15:57 to 17.09. Communications were legible.

1.10 Aerodrome information

The aerodrome LKTB is public international airport. There was IFR traffic of two aircraft.

1.11 Flight recorders

On board the aircraft there was no equipment whose record could have been used to the flight analysis.

1.11.2 ATS recordings

Recorded were communications, radar data, and inputs from units at FIC, TWR EC and MAPP Pardubice. Recordings from D-EREU flight were used for analysis.

1.12 Description of crash site and aircraft

In position 7 NM NW LKTB the pilot made an emergency landing on blacktop highway R43 (Hradecká street in direction from Brno to Svitavy) approx 8.8 m wide.

Judging by tire wear, the plane first touched down its main undercarriage right wheel landing in the right traffic lane. Then the right wing hit a public lighting pole no.171. At the same time the main undercarriage left wheel ran onto R43 crash barrier. Then the nose wheel struck the road, the nose landing gear leg broke and the plane's nose rubbed against the road surface. Finally the plane came to halt in the right motorway lay-by.

Scattered around were chips of nose undercarriage cover.

Instrument equipment was not damaged. The main switch was in "off" position. The actuator controlling rich gas ratio was slightly before position "completely lean mixture" and the gas lever was in position slightly before idling. The actuator to control carburetor heating was in position 1/3 heat. The altimeter was set at pressure 1 008 hPa (29.76 IN.Hg) to show a height of 740 ft. The other instruments and indicators to check the aircraft conditions were at zero positions. Mode C and code 3331 were set on the SSR transponder box. About 90 l fuel, nearly full tank, was left in the right wing tank after landing.

After inspection at the crash site, the airplane was transferred to aerodrome Brno/Tuřany for a detailed technical inspection of the fuel system, which was held on 18. November 2010. For aircraft state, see photos in Appendix 1.

1.13 Medical and pathological information

During the flight the pilot was not influenced by drugs prohibited when flying. CR Police had the crew breathalysed with negative results.

1.14 Fire

There was no fire at the accident location.

1.15 Survival aspects

TWR EC informed Firemen and Rescue Team by phone about D-EREU flight conditions at 17:10:34. This information followed a report by an eye witness announcing a plane was landing on the road. At 17:12:13 TWR EC reported the accident to RCC Praha.

1.16 Tests and research

NIL

1.17 Organizational and management information

1.17.1 FIC Praha unit

FIC Praha is part of ACC Praha in terms of its organization structure. FIC has a surveillance radar system IDP installed. Regarding the pilot-in-command responsibility for flight execution, FIC provided information based on the reports from the D-EREU pilot.

1.17.2 LPS Brno unit

The unit had APP and TWR positions filled. Air traffic controllers' procedures are set in Emergency Procedures (version 1.0) Part 3.3 Crash of Aircraft off the aerodrome. The procedure is part of VALDO system and is accessible from TWR EC and APP EC units.

1.17.3 MAPP/TWR Pardubice unit

The aerodrome is a military airport with civil air traffic. Management's office hours and civilian flight operations are Monday through Friday from 07:00 to 21:00 (06:00 to 20:00 Central European summer time). Flights outside operation time on Sundays, Saturdays and bank holidays are only on request 24 hours beforehand in operation times.

1.18 Additional information

1.18.1 VFR night flights

AIP CR stipulates in part ENR 1.2 for the Czech Republic Prov. 1.2.4 VFR Night Flights among other things the following:

- a) VFR night flights in CTR and TMA (MCTR and MTMA as controlled flights,
- b) VFR night flights in airspace class E above 5000 ft AMSL and in airspace class C as controlled flights,
- c) VFR night flights in airspace class E above 1000 ft AGL, and up to 5000 ft AMSL incl., and in airspace class G as non-controlled flights.

1.18.2 Phraseology

Air regulation Phraseology stipulates in Prov. 12:4 in connection with fuel shortage the following:

12.4

12.4 NEDOSTATEK PALIVA	FUEL SHORTAGE
L: MAYDAY MAYDAY MAYDAY - NOUZOVÉ PALIVO / NÍZKÝ STAV PALIVA <i>Pozn.: Velitel letadla musí vyhlásit stav nouze, je-li skutečné množství použitelného paliva na palubě menší než konečná záloha paliva. (Příloha III k nařízení Rady (EHS) č. 3922/91; OPS .375(b)(3)).</i>	A: MAYDAY MAYDAY MAYDAY – EMERGENCY FUEL / LOW ON FUEL <i>Note: The pilot in command shall declare an emergency when the actual usable fuel on board is less than final reserve fuel. (Annex III to the Council Regulation (EEC) No 3922/91; OPS 1.375(b)(3)).</i>

L: *PAN – PAN, PAN – PAN, PAN – PAN*

MINIMÁLNÍ PALIVO

Pozn.: Minimální palivo znamená množství paliva k letu na letiště, na kterém lze provést bezpečné přistání při zbytku paliva rovném konečné záloze paliva.

A: *PAN – PAN, PAN – PAN, PAN – PAN*

MINIMUM FUEL

Note: Minimum fuel means the amount of usable fuel required to proceed to the aerodrome where a safe landing can be made, with final reserve fuel remaining.

The international standard phraseology is set in ICAO Annex 10 Volume II Chapter 5 and in ICAO Doc 9432 : “Manual of Radiotelephony”.

Pilots are urged – in their own interests – to request assistance from the emergency service as soon as there is any doubt about the safe conduct of their flight. Even then, the provision of assistance may be delayed if a pilot does not pass clear details of his difficulties and requirements, using the international standard RTF prefix ‘MAYDAY, MAYDAY, MAYDAY’ or ‘PAN PAN, PAN PAN, PAN PAN’ as appropriate. For example, a vague request from a pilot for ‘confirmation of position’ is unlikely to be accorded as much priority as would be given to a statement that he is lost. If, subsequent to the transmission of a ‘MAYDAY’ or ‘PAN’, a pilot considers the problem not to be as serious as first thought and priority attention is no longer required, the emergency condition may be cancelled at the pilot’s discretion. It is invariably preferable for pilots believing themselves to be facing emergency situations to declare them as early as possible and then cancel later if they decide the situation allows.

1.19 Useful or effective investigation techniques

The cause of the air accident was investigated in accordance with ICAO Annex 13.

2 Analysis

2.1 General

Malfunction of the fuel system after the auxiliary fuel cock had been switched over to fuel supply from the right wing tank caused the fuel pressure and revolutions to drop, engine irregular run, and interruption of fuel supply to the engine. The pilot was not able to find out in flight what exactly the fuel problem was. The only information was the amount of fuel and its pressure as indicated on fuel meters and on auxiliary tank fuel gauge. The engine stopped working because there was no more fuel in the left wing tank and in the auxiliary tank, although there was enough fuel (approx. 90 l) in the right wing tank.

It followed from his statement that the pilot, after finding out the problem with the fuel supply, particularly after finding there was no fuel left at all, was faced with an extremely plight regarding emergency landing at night.

2.2 Operations

2.2.1 Pilot’s rating and experience

The pilot was airworthy, his experience and skill was sufficient to assume the responsibility to make a VFR night flight.

Although he could have had some experience in the past and the installation of an auxiliary tank could not have imposed more demands on him, he was not authorized

to interference with the aircraft fuel system. He knew that the tank installed was not connected to the fuel piping and he also knew it would be necessary to connect and test the auxiliary installed fuel system filled with fuel before the flight.

On 14 November 2010 he executed duties as a sole-occupant PIC from 12:34. At the time of the accident the flying time was 4 h 34 min.

2.2.2 Execution of flight

It followed from the FPL track legs that the total flight length was to be 1080 km (583 NM). The total amount of fuel tanked, 74 U.S. gal, would have been enough for flight from the departure aerodrome to the scheduled destination.

The pilot took off at 12:34 and the total track EDXF – LUB – BKD – HDO measured 550 km. A radar record showed the plane flew over HDO at 15:55, its flight time amounting to 3 h 21 min. The pilot said he was taking fuel from the left wing tank from the take-off time at 12:34 (12:42) to 13:52, i.e. for 1.3 h. Fuel consumption and the fuel left in the tank was likely to correspond to this time, allowing for richness of the mixture:

Mixture [U.S.gal/h]	Consumption [U.S.gal/h]	Fuel residue in left wing tank
8.2	10.66	13.34
9.5	12.35	11.65
11	14.3	9.7

The pilot said he took fuel from the auxiliary tank in the time period from 13:52 to 16:15. With regard to amount of fuel in the auxiliary tank 100 l (26 U.S. gal), the average fuel richness of 11 U.S. gal/h. corresponded to the amount of fuel spent and length of this track leg on FL 70.

From 16.15 the pilot took usable amount of fuel from the left wing tank till its depletion, which happened after 45-minute flight including descent from FL 70 to 4800 ft AMSL. To these values corresponded the following amount of spent fuel, taking into account the fuel mixture:

Fuel mixture [U.S. gal/h]	Rest of fuel in left wing tank [U.S. gal./h]
8.2	6.15
9.5	7.13
11	8.25

The usable fuel amount in the left wing tank at the moment of switch to auxiliary tank was very likely less than half the tank volume.

Although the plane flew at night, shortly after entering FIR Praha at 15:57:10 the pilot reported on FIC frequency as a VFR night flight on FL70. With respect to night VFRs, it was not a right move. According to AIP CR ENR 1.2 prov. 1.2.4, the pilot should have known he was to establish contact in IFR sector to be cleared for flight. A night VFR flight in class E airspace above 5000 ft AMSL must be executed as

a controlled flight. Therefore it must be in contact with ACC IFR sector. FID was aware of this fact. However, as at another previous VFR night flight above A050, he had been misinformed by ATCO IFR sector that it did not need contact with flight in question, he retained D-EREU on FIC frequency. The relevant IFR sector was informed on D-EREU and provided it with services under class D through FID. FID retained contact with the flight despite the fact he cannot provide air traffic control service. He assigned SSR A3331 code and let the flight proceed as a VFR night flight, and in front of MTMA Pardubice horizontal limits he retuned it in MAPP Pardubice. He did not pass on information about the fuel supply problem to MAPP Pardubice. Although it followed from the pilot's statement that at that time he expected the flight to be normal with landing at LHTL destination aerodrome, it is likely that ACC Praha air traffic controller would have done so.

2.2.3 Problem identification

After all the usable fuel had been spent in the auxiliary tank, from which the fuel was being taken from 13:52, the pilot at 16:15 switched the fuel cock to take fuel from the right wing tank. Shortly after that he found out that fuel supply from the right wing tank did not work. He solved the situation by switching the fuel tank selector valve to the left wing tank whereupon the supply resumed. Since he estimated the fuel in the left wing tank would only suffice for 45 minutes' flight, he sent a report at 16:21:46 about the problem: *"We have problem with transferring our fuel, I think we have to divert to LKTB"*.

However he did not use a standard emergency signal "MAY-DAY to be used in case a plane has a serious problem and needs instant help, neither he issued a distress signal "PAN-PAN" to be used when the plane safety is at risk or if there is a dangerous situation that may call for assistance.

It followed from the pilot's report he supposed to land at LKTB, but FID was not able to assess how risky the situation was if the flight continued and only confirmed the information that LKTB will surely be open. At that time the flight was 162 km away from LKTB and flew on FL 70 at cruise airspeed of 120 kt. Time limits to reach LKTB was 44 minutes.

At 16:22:33 FID retuned in the frequency MAPP LKPD. However, he did not pass on the fuel problem information to MAPP LKPD. Although it was mainly the pilot's duty to declare seriousness of the situation, this piece of information by FID could have drawn MAPP EC attention to the potential problem.

Following information to go over to frequency MAPP LKPD at 16:23:31, he did not use a standard emergency phrase, just announcing: *...we should divert may be on your field or LKTB"*. The report did not contain any distress request to land at LKPD nor did the pilot report the serious situation due to little fuel to proceed to LKTB. Therefore MAPP EC responded saying: *...confirm you are proceeding to LKTB"*.

The pilot knew about the low fuel reserve aboard and wanted to solve the situation by landing at LKPD. In spite of that in the following report: *...we will land at your field LKPD. OK I land in your field."* he did not use a standard emergency phrase, either.

Owing to lack of information, MAPP EC kept insisting he would not issue a clearance to land at LKPD, which at that time was not open for civil traffic. He checked

by radiophone that LKTB aerodrome was open and RWY 10 was in use. He passed on this information to the pilot and issued an instruction to go over to contact FIC Praha.

Though the pilot communicated his intention to land, he said nothing about his fuel problem and did not declare “Emergency fuel” to report that the actual amount of fuel aboard was less than the quantity needed to a safe nocturnal VFR flight to LKTB airport, which meant he was in fact facing the state of emergency. It was evident that MAPP EC did not have enough information to view the plane as a machine heading for a fall. There is no doubt that if distress or emergency had been declared, MAPP EC would have taken all steps to secure landing at LKPD.

Data from ATS records show that at that time the plane was 112 km away from LKTB. The pilot stated in the report that based upon GPS data, he had supposed to get to LKTB in 32 minutes.

2.2.4 History of emergency landing

The pilot did not use emergency signal “MAY-DAY” or distress signal “PAN-PAN” even at 16:49:51 when he established contact with APP Brno. Consequently, contact established, APP EC did not think the plane was in emergency and gave instruction to approach to LKTB in a standard way. However, given the real situation, there is no doubt that in this phase he was not able to provide any more effective assistance, anyway. Data from ATS recordings show that at that time the pilot flew straight flight heading for LKTB, descending from flight level 6500 ft to 5100 ft AMSL at an airspeed of 110 kt.

At 16:58:37 while in contact with TWR EC, the pilot did not use emergency signal “MAY-DAY” or distress signal “PAN-PAN”, either. At that time he did not see the airport yet and TWR EC informed the pilot he was in position 16 NM (29.6 km) from LKTB. According to a radar record he was on level 4,700 ft AMSL. Despite the fact the pilot already knew how serious his situation was he did not declare emergency even when TWR EC asked him about his intention to proceed from LKTB. So TWR EC did not know the problem thoroughly and proceeded in a standard way, just securing the aircraft turn around after landing.

The pilot continued to descend at a speed of 80 kt and during another two minutes he reached the level 4,300 ft AMSL (approx. 2,850 ft AGL) south of the town of Kuřim.

The first report about the serious situation TWR EC received was the pilot’s message: “... *we have big big problem, D-EREU we have big problem, we have emergency landing to do.*” The report by TWR EC there was a Medlanky airfield in the descent direction led to a slight change in heading to the right, but the pilot did not see yet the Medlanky airfield. However, it is very unlikely that at night, based only on this information and GPS, it was possible to land at Medlanky airfield.

The situation following the engine conk-out can be derived from ATS records and a pilot’s description. The pilot knew about fuel depletion in the left wing tank and in descending he sought the opportunity to emergency landing. Replying to TWR EC’s question at 17:05:14 whether he could proceed to LKTB the pilot first said he was not sure because as he put it: “... *I am liquid my fuel and I have minutes economy but it is at least 7 min to fly, it is not possible fly so long way.*” A moment later, responding to an announcement by TWR EC that LKTB was 5 minutes ahead, the pilot said he was not sure he could proceed another 5 minutes. He was descending at an average vertical speed of 800 ft/min and at 17:07:30 reached a level of 1,400 ft AMSL.

The pilot's report at 17:07: ...*"I will crash in few minutes."* points to an imminent threat, making him decide to try to make an emergency landing *"...I try to land, we..., I am not sure."* on a motorway R43, left to the flight path, lit by public lighting, as the only solution possible in the given circumstances. The pilot most probably had no other possibility to make a night emergency landing, taking into account the broken terrain, buildings around, and flight conditions. Hence it was natural he drew attention to cope with emergency landing on R43 motorway, including the manoeuvre to avoid the bridge he saw when on descent as late as just before touching down.

The pilot in the hold-off phase probably could not avoid collision, taking into account the small width of road 8.8 m and trees on the right edge slope forming an obstacle, and the plane's left wing struck a pole of public lighting in the separating grassy strip.

2.3 Technical analysis

2.3.1 Connecting an auxiliary fuel tank

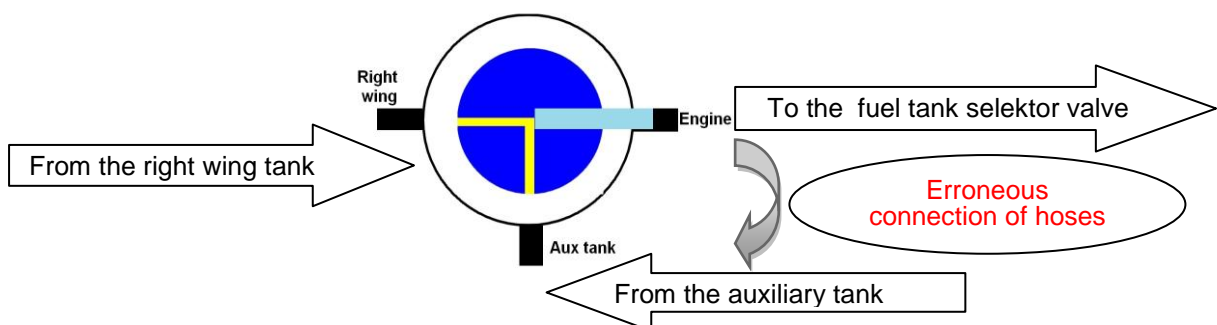
The pilot's statement shows he was facing an extraordinary stressful situation, which forced him to make a night emergency landing, on having found out the fuel problem, particularly after the fuel supply from the left wing tank had been completely cut off due to the fact there was no fuel left.

For the reason given above, the aircraft inspection was focused on the functioning of the fuel system. The auxiliary fuel tank cock was tested with the aid of pressure air. When testing cock positions and their reactions, a malfunction of switching fuel paths in the cock was discovered. The reason was erroneous connections of hoses to the fuel cock. The inlet hose from the auxiliary tank was connected to the socket to which should have been connected the outlet hose to the fuel tank selector valve that feeds fuel to the engine and vice versa.

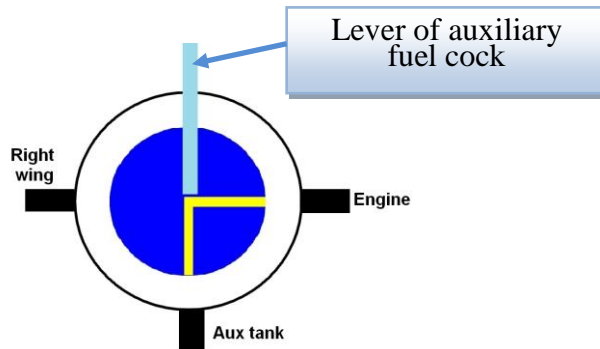
The following positions corresponded to the wrong connection of the auxiliary fuel cock:

a) Shut of a fuel path from the right wing tank and the auxiliary tank into fuel pipe to the selector valve of fuel supply. In this position, only the right wing tank was connected with the auxiliary tank:

- Fuel from the auxiliary tank could flow by virtue of gravity to the right wing tank which was located cca 27 cm lower. When the right wing tank was full, the fuel could flow out of the plane through air vent,
- Fuel from the right wing tank could not flow to the auxiliary tank due to its location.



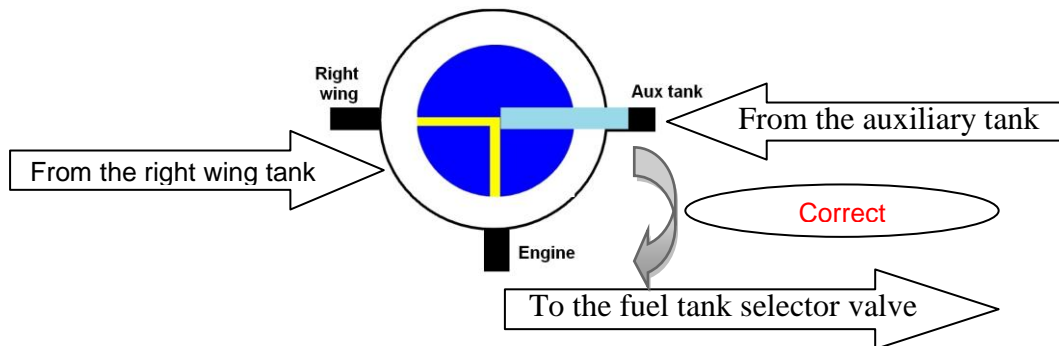
b) Position to take out fuel from auxiliary unit. If the cock was set to this position, fuel flow from the auxiliary tank into the fuel pipe to fuel tank selector valve only. This position of the auxiliary fuel cock does not enable fuel to be supplied into the system from the right wing tank.



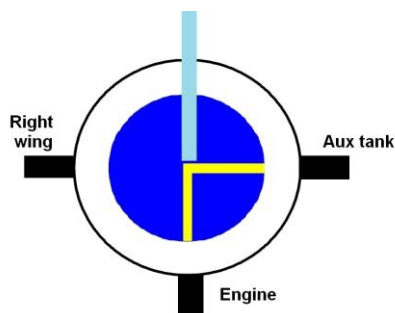
For the auxiliary fuel system to work properly, hose connection to the auxiliary fuel cock would have had to enable working positions to be set as follows.

The following working positions corresponded to correct connection of the auxiliary fuel cock:

a) Pipe connection of right wing tank into fuel pipe leading to fuel tank selector valve.



b) Pipe connection of auxiliary tank into fuel pipe leading to fuel tank selector valve.



The pilot had failed to choose the right testing procedure when he tested the modified fuel system. Maybe he had not checked all the working positions of the fuel supply cock, omitting to test connection between the right wing fuel tank and pipe leading to the fuel supply cock. Therefore the pilot had not discovered the wrong connection of hoses before the flight.

If he had tested the fuel system in the right way, fuel supply to engine would have been cut off immediately after setting the auxiliary fuel cock to the right wing tank.

3 Conclusions

3.1 The commission determined the following conclusions:

3.1.1 Pilot

- Had valid rating for VFR flight and valid medical,
- No healthy problems were found out that might have led to emergency land.

3.1.2 Airplane

- Airworthiness certificate was valid,
- The “Aéroclub du Sud” did not perform the necessary actions to request a supplementary type certificate from EASA in order to allow the use of an auxiliary fuel tank, which was necessary for this flight,
- EASA did not issue STC for installation of auxiliary fuel system,
- Crew tampered with the fuel system and connected fuel hoses to auxiliary fuel cock in a wrong way, resulting in the cock being connected to the auxiliary tank only,
- Wrong connection of right wing tank resulted in, regardless of position of auxiliary fuel cock, interruption of fuel supply from right wing tank to engine,
- Total amount of fuel corresponded to time planned for flight from take off aerodrome to airport of destination,
- Flight was executed without prior testing correct function of fuel supply and fuel in right wing tank could not be used during flight,
- Before hitting obstacle, airplane was gliding in normal landing configuration, with its engine not working,
- Airplane was damaged due to forces caused by airplane hitting obstacle and falling on ground.

3.1.3 Execution of flight

- Before taking off from EDXF, pilot tested fuel system in such a way that reliable fuel supply from all aircraft’s tanks could not have been verified,
- Pilot started flight being aware of fact that he and other persons without proper maintenance qualifications manipulated with fuel system and without STC,

- Total amount of fuel was sufficient for flight from takeoff aerodrome to aerodrome of destination; usable amount of fuel in left wing tank and auxiliary tank was not sufficient for safe flight to aerodrome of destination,
- When auxiliary fuel cock was in position to take fuel out of right tank and on condition there was fuel in auxiliary tank, fuel could gravity-flow to right tank and from it, through air vent pipe of right tank, outside aircraft,
- Regarding length of time fuel was being taken from auxiliary tank, fuel leak was not likely to happen,
- Pilot first identified fuel problem at 16:15 when flying in FIR Praha, as engine began to lose power following switch to right wing tank and consumption of fuel in pipes,
- Pilot was not able to do away with technical problem of fuel supply, but was able to find out what sort of situation he was in and use correct phrases corresponding to emergency,
- Pilot made it impossible to get more help from ATS because he did not declare on FIC and MAPP frequencies distress or emergency to make clear his fuel problem and intention to quickly land on a near airfield available,
- FID did not register the part of message concerning fuel problem, so he did not ask pilot to clarify situation. He did not coordinate flight with MAPP Pardubice as a controlled flight. He gave information to APP Brno that he would divert flight to Brno because of a fuel problem. At that time amount of fuel was sufficient for a safe landing at LKPD,
- TWR EC ensured, based on state of emergency signalled by pilot, relevant information needed and activated rescue services,
- Engine stopped working due to exhausting rest of usable fuel in left wing tank and auxiliary tank,
- Immediately after engine conked out, pilot solved situation by trying to land on a motor way flanked on either side with obstacles, the lit road being the only surface suitable for landing at night,
- Aircraft was damaged due to crash into obstacle during landing.

3.2 Causes

The air accident was caused by:

- a sequence of mistakes made by the pilot and other persons, who before flight and without authorization manipulated with aircraft fuel system. Their unqualified manipulation of and insufficient after-check on the fuel system did not reveal a malfunction in supplying fuel from the right tank.
- wrong and insufficient communications between the pilot and ATC concerning little fuel, exhausting of fuel reserve and subsequent engine breakdown

3.2.1 Contributing circumstances

Flying in night conditions adversely affected the situation, to.

4 **Safety recommendations**

No safety recommendation has been issued.

The airplane state after inspection



Fig. 1 Warning sign on the plane written in the logbook page



Fig. 2 Overall view of damage airplane



Fig. 3 Damaged of left wing



Fig. 4 Damaged of left wing



Fig. 5 Damaged of ride side the aircraft propeller



Fig. 6 Damaged of left side the aircraft propeller



Fig. 7 Damaged of the left wing/fuselage midsection attachment



Fig. 8 Damaged of the nose landing gear leg



Fig. 9 Auxiliary fuel system instalation place



Fig. 10 Position of the lever auxiliary fuel cock after forced landing



Fig. 11 The lever auxiliary fuel cock in the position when the right wing tank was connected only with the auxiliary tank

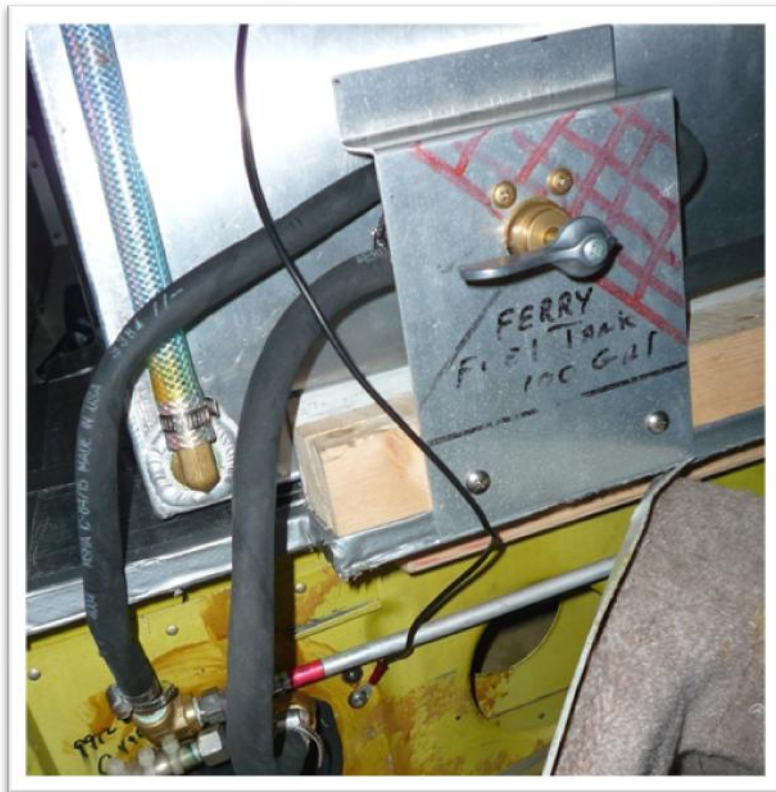


Fig. 12 The position of the lever auxiliary fuel cock, when the right wing tank was disconnected

Filed flight plan the airplane DEREU

