ACCIDENTS INVESTIGATION BRANCH
Department of Trade and Industry

Piper PA23-235 G-ASKW

Report on the accident in the sea 18 nautical miles southeast of Southwold, Suffolk on 25 February 1971

LONDON: HER MAJESTY'S STATIONERY OFFICE
1972

List of Civil Aircraft Accident Reports issued by AIB in 1972

No.	*Short title*	*Date of publication*
1/72	Comet 4 G–APDN in the Sierra del Montseny near Barcelona, Spain, July 1970	February 1972
2/72	Bristow Helicopter Agusta Bell 206A Jet Ranger G–AVSV near Fetteh Gomoah, July 1970	February 1972
3/72	Piper PA23-235 G–ASKW in the sea off Southwold, Suffolk, February 1971	February 1972

SBN 11 510648 0

Department of Trade and Industry
Accidents Investigation Branch
Shell Mex House
Strand
London WC2

17 December 1971

The Rt. Honourable John Davies MBE MP
Secretary of State for Trade and Industry

Sir,

I have the honour to submit the report by Mr G M Kelly, an Inspector of Accidents, on the circumstances of the accident to Piper PA23–235 G–ASKW which occurred in the sea 18 nautical miles southeast of Southwold, Suffolk on 25 February 1971.

I have the honour to be
Sir,
Your obedient Servant,

V A M Hunt
Chief Inspector of Accidents

Accidents Investigation Branch

Civil Accident Report No EW/C371

Aircraft:	Piper PA23–235 G–ASKW	
Engines:	Two Lycoming 0–540–B	
Owner:	Jones, Stroud & Co Ltd, Long Eaton, Nottinghamshire	
Operator:	King Aviation Ltd, East Midlands Airport, Derbyshire	
Crew:	Captain A D D Pearson	Uninjured
Passenger:	Mr K A Watts	Uninjured
Place of Accident:	In the sea 18 nautical miles southeast of Southwold, Suffolk	
Date and Time:	25 February 1971 at 1120 hrs.	
	All times in this report are GMT	

Summary

The aircraft was on a flight from East Midlands Airport to Rotterdam. An electrical malfunction led to the loss of all radio and navigational aids when the aircraft was flying over The Netherlands in visual meteorological conditions (VMC) above complete cloud cover. The pilot returned above cloud to Britain and eventually let down in a clear area off the coast of Suffolk. Finding that the cloud base was 500 feet with mist below precluding flight in VMC, he ditched some 18 miles from the coast near a trawler which picked up the aircraft's two occupants. The report finds that the evidence is insufficient to determine the cause of the electrical failure.

1. Investigation

1.1 History of the flight

The pilot boarded the aircraft at 0640 hrs on 25 February 1971, started both engines on the aircraft battery, taxied to a re-fuelling point and switched off. After re-fuelling the engines were again started on the aircraft battery. On each of the four starts the engines turned over easily and started without difficulty. The run-up procedure carried out before take-off included a separate check of each generator and the pilot was satisfied that both were functioning properly, as was the rest of the aircraft's equipment. The aircraft took off at 0742 hrs and at 0833 hrs having just passed Clacton on Airway Red 1 it was handed over from London to Amsterdam Air Traffic Control (ATC). Normal two-way communications with Amsterdam was established on 125.75 MHz. At this stage all radio, navigational and electrical equipment was functioning normally. The pilot later reported that he had looked at the ammeter in the normal scan of his instruments but did not notice the needle in any position other than its normal 'Zero'.

The flight continued uneventfully until shortly after 0900 hrs, when the aircraft was flying above unbroken cloud at flight level (FL) 90 between the Valkenburg and SNV radio beacons. At this stage the pilot noticed that Amsterdam's signals appeared weak. It was also apparent to him that Amsterdam was not receiving his transmissions. Shortly afterwards both very high frequency omni directional range (VOR) and the automatic direction finding (ADF) receivers ceased functioning. The pilot tried several stations without success. Whilst he was doing this he switched off the pilot heater, cabin heater and rotating beacon. He then saw that the ammeter needle was in the zero or slightly discharge position and he switched each generator off and on again in turn. The needle remained stationary. After checking all the circuit breakers the pilot switched off both VOR sets and the ADF, leaving the No 2 VHF radio set on. He continued on course at FL 90 and made calls on the distress frequency of 121.5 MHz without receiving a reply.

The aircraft was above 8/8 strato-cumulus cloud, the tops of which were about 4,000 feet. These cloud conditions were markedly worse than forecast and the pilot decided not to descend over The Netherlands but to return to the Southend area, flying VMC on top of cloud, in the hope that the slow-moving warm front noted in his pre-flight weather forecast would have passed through by the time he arrived and that the weather would be suitable for a visual let-down. He set course for Southend, estimated that the flight would take one hour, and flew at FL 50 still VMC above cloud.

The compass and all the flight instruments except the turn and slip indicator were independent of electrical power and were functioning properly. The turn and slip indicator, a DC electrical instrument, continued to work and the amber 'landing gear up' light remained illuminated. However the pilot observed that the electrical fuel gauges showed considerably less fuel than his calculations indicated the tanks should contain.

On the way back to Southend the pilot saw the sea twice and descended to explore the cloud base but finding this to be at 500 feet and observing mist below he decided to continue on top of cloud. At his estimated time of arrival of 1015 hrs the aircraft was still above unbroken strato-cumulus, and the pilot spent some 45 minutes flying a right hand triangle of 1-minute legs at 5,000 feet. During this time he attempted to get the use of a navigation aid and made distress calls on 121.5 MHz, both without success. Inquiries subsequently established that the aircraft was not seen on radar and none of its transmissions were heard.

At about 1100 hrs the pilot decided to turn east and let-down over the sea. The fuel gauges were by now showing zero (although his calculations indicated that he had about 1½ hours fuel remaining), the amber undercarriage light had now become dim, but the turn and bank indicator still appeared to be functioning. A gap in the cloud was seen with the sea visible and the pilot descended to find a cloud base of 500 feet with mist below. He considered that it was unsafe to approach land in these conditions and decided to ditch near a trawler which was now in sight.

After briefing the passenger, life jackets were donned and the pilot attracted the trawler's attention indicating his intention to ditch by low fly-pasts during which the undercarriage was extended and retracted and the engine note varied. The trawler quickly realised the significance of these manoeuvres and started to take in its trawl. When this had been done and the trawler was prepared, the pilot ditched the aircraft nearby at about 1120 hrs.

The trawler quickly rescued the crew and put down a buoy to mark the aircraft's position at 52°08'N 02°02'E.

1.2 Injuries to persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal	-	-	-
Non-fatal	-	-	-
None	1	1	-

1.3 Damage to aircraft

The aircraft sank and was not recovered.

1.4 Other damage

None.

1.5 Crew information

Captain Andrew Dominic Dilworth Pearson, aged 29, held a valid commercial pilot's licence, with an instrument rating and an endorsement for command of Piper PA23 aircraft. His last competency check on the PA23 was on 30 December 1970 and his last line check was on 2 February 1971. Captain Pearson's total flying experience was 605 hours, of which 208 were on the PA23. He had flown 35 hours in the last 28 days, and had been off duty for two days before reporting for the flight on which the accident occurred.

1.6 Aircraft information

The aircraft, serial number 27-576, was constructed in the United States of America in 1963. In the same year it was purchased by Jones, Stroud and Company Limited and registered in the United Kingdom. It was operated since then on behalf of the registered owners by King Aviation Ltd. At the time of the accident it had flown a total of 2,056 hours, of which 433 hours were since the last renewal of its certificate of airworthiness. The certificate of airworthiness was valid until May 1971 and a certificate of maintenance issued on 23 January 1971 was valid at the time of the accident.

The maintenance records showed that the aircraft had been maintained in accordance with an approved schedule and there were no items outstanding in the technical log. The records also showed that a comprehensive check of the electrical system was carried out during the Check 2 inspection on 23 January 1971, and no electrical defect had been reported since.

The aircraft was equipped with a 12V 50A belt-driven generator on each engine, and one 35 ampere-hour battery. An ammeter was fitted on the starboard instrument panel but there was no other method of warning of a loss of power supply from the generators to the bus-bar. Each generator had a switch and a voltage regulator. A paralleling relay shared the total electrical load equally between the generators, and in the event of one generator failing a reverse current relay automatically disconnected that generator from the circuit. The output of each generator was taken to the main bus-bar through a circuit breaker and thence to the 35 ampere-hour battery. The entire output of either generator could be switched on or off by manual operation of its related field circuit switch. These switches were mounted on the central control pedestal.

1.7 Meteorological information

Weather forecast: The pilot received a route forecast via teleprinter from Birmingham Airport. It stated that a slow-moving warm front would lie from Aberdeen to Ostend at 0600 hrs. In the frontal zone there would be low stratus and hill fog patches, with 8/8 strato-cumulus base 2,000 and tops

8,000 feet. In the extreme east of the route cloud would be 3/8 cumulus base 2,000 and tops 10,000 feet. The landing forecast for Rotterdam and for Amsterdam (the alternate) was:

Wind	290°/13 knots, becoming 320°/20 to 30 knots
Visibility	over 10 kilometres
Cloud	2/8 cumulus base 2,000 feet.

Actual weather: An appreciation prepared during the investigation showed the weather to be as follows:

General situation: A northwesterly airstream covered the area covering the East Anglian coast to Rotterdam and Amsterdam throughout the period. The remains of a stationary weak warm front lay northwest to southeast from the Wash to Ostend.

Winds:

Surface	270° to 310°, 5 to 10 knots in the west 300° to 340°, 10 to 15 knots in the east
5,000 feet	330° to 350°, 15 knots over East Anglia, increasing to 25 to 30 knots over The Netherlands
10,000 feet	330° to 350°, 20 knots over East Anglia, increasing to 30 to 40 knots over The Netherlands

Surface visibility: 1 to 3 kilometres near the English coast and locally less than 800 metres in fog patches in the frontal zone, but generally over 15 kilometres east of longitude 2½°E.

Freezing level: 3,000 feet.

Cloud: Variable patches of sea fog or low stratus base 600 feet or below, locally 6/8 to 8/8 lifting to 600 to 1,000 feet towards the Dutch coast. 6/8 to 8/8 strato-cumulus base 2,000 to 3,000 feet tops 5,000 feet, but with large breaks in this cloud layer developing towards the Dutch coast during the latter half of the period. 6/8 to 8/8 alto-cumulus and alto-stratus at 15,000 to 20,000 feet in the frontal zone clearing eastwards.

Rotterdam and Amsterdam: From 0855 to 1155 the weather at Rotterdam and Amsterdam was:

Visibility	over 10 kilometres
Cloud	1/8 cumulus base 2,000 to 2,500 feet and 7/8 strato-cumulus base 3,500 to 4,000 feet.

1.8 Aids to navigation

The aircraft was equipped with:

One combined VHF communications and VOR set
One VOR set
One VHF radio set
One ADF set

1.9 Communications

G–ASKW's communications with air traffic control stations at the departure airfield and en route were normal until 0851 hrs when Amsterdam was contacted on 125.75 MHz. From this time onward Amsterdam was receiving the aircraft's transmissions weakly although the aircraft was receiving Amsterdam at strength 5 up to 0856 hrs. Amsterdam tried without success to communicate with the aircraft from 0859 hrs onwards.

After losing contact with Amsterdam on 125.75 MHz, the aircraft transmitted messages on Rotterdam Tower on 118.2 MHz. Following this, over The Netherlands and later over the UK, the aircraft transmitted on 121.5 MHz. No station picked up any of these calls.

1.10 Aerodrome and ground facilities

Not relevant.

1.11 Flight recorder

No flight recorder was required nor was one fitted in the aircraft.

1.12 Examination of the wreckage

The wreckage was not recovered. It was considered that since the investigation largely concerned electrical failure and that the evidence concerning this would be severely impaired by contact with sea water, raising the wreckage could not be justified. This view was accepted by the airworthiness and air safety authorities. The owner also decided not to raise the aircraft.

1.13 Fire

There was no fire.

1.14 Survival aspects

Survival equipment: The only sea survival equipment carried in the aircraft were life jackets fitted with a light and whistle.

The ditching: The ditching was carried out with the flaps and wheels up, and with the cabin door opened to lessen the chance of it jamming. A powered approach was made and the aircraft touched down in the normal landing attitude 65 to 70 knots into a 5-knot wind in calm sea. There was a smooth

deceleration until the speed had fallen considerably when the nose dug into the water and the aircraft came to a sudden stop. It floated substantially level while the two occupants climbed on to the starboard wing and inflated their life jackets. About two minutes after coming to rest the aircraft sank quickly, nose first, and the survivors were at once rescued from the water by the trawler.

Search and rescue: Shortly after Amsterdam Air Traffic Control's last contact with the aircraft at 0859 hrs its radar echo faded from their screen. They then initiated search and rescue action over The Netherlands and the adjacent sea areas and informed the UK ATC authorities. The search continued until the Dutch authorities were informed that the aircraft's occupants were safe.

1.15 Tests and research

The wreckage was not recovered and no evidence of the aircraft's pre-crash condition could be obtained. A study of the electrical system of this type of aircraft indicated that if the charge current to the battery ceased then the performance of the aircraft's radio would progressively deteriorate as the electrical pressure from the battery fell below 11 volts. Thereafter normal flight electrical loads would be likely to exhaust the battery in about 45 minutes.

Research of the records of the Air Registration Board, other operators of this type of aircraft and maintenance organisations with experience in servicing the type revealed an almost total absence of information on complete electrical failure in this type of aircraft. An inspection of historical records showed only random causes for electrical failures of any sort.

2. Analysis and Conclusions

2.1 Analysis

The loss of electrical power after the failure of the radio equipment indicates a failure of the supply from the generators. In the absence of wreckage and the lack of any indication of other than random causes of electrical failures in the recorded history of this aircraft in particular and of Piper PA23 aircraft in general the cause of this particular failure could not be established.

From the time the aircraft battery became the sole source of electrical power about 20 minutes would elapse before the radio failed and after a further 45 minutes all the electrically operated services would cease to function. Radio failure, according to the record of R/T communications occurred at 0852 hrs and, according to the pilot's statement, the electrical power had become insufficient to operate the fuel contents gauges between 40 and 60 minutes later. From this it can be inferred that the malfunction of the electrical system occurred about 0830 hrs. The possibility that the pilot took off without having switched on the generators can therefore be discounted.

There was no generator failure warning system fitted to the aircraft. It was to be expected that any indication of malfunction in the electrical system would appear either on the circuit breaker panel or on the ammeter in the form of an abnormal deflection of the needle. The pilot, however, observed only normal indications during flight with a slight discharge after the radio failure and no movement of the needle when he switched off each generator in turn. The latter symptom indicates that the supply from both generators had failed. The discharge indication would show the rate at which power was being drawn from the battery.

Having suffered a radio communications failure and shortly afterwards a radio navigational aids failure the pilot was now bound to put into effect one of the procedures for radio failure in a controlled airspace. Dutch procedures are based on those of ICAO, as are those in the *UK Air Pilot*. The appropriate procedure was that specified for an aircraft with radio failure and insufficient navigational assistance obtainable to enable the current flight plan to be followed. That is, to leave the controlled airspace and either fly to an area in which the flight may be continued in VMC or if this is not possible select a suitable area in which to descend through cloud, proceed visually to a suitable aerodrome and land as soon as practicable.

It would in fact have been possible to follow this procedure over The Netherlands, but this was not apparent to the pilot, who was flying over complete cloud cover although the weather forecast had prognosticated only 3/8 cover for this part of the route. He elected to retrace his track in the hope of flying out of the area influenced by the slow-moving front referred to in his weather forecast and to make a descent in VMC behind it. In fact he unwittingly flew away from an area where a landing in good VMC could have been made after a descent through cloud and into an area where a descent, even through a gap in the cloud would take the aircraft into low stratus and poor visibility.

The sea became visible in due course but the coast of The Netherlands appeared to be shrouded in mist and the pilot therefore decided to continue towards Southend rather than attempt visual flight over the Dutch mainland. At Southend there was still full cloud cover below him and feeling unable to descend with safety the pilot attempted to make radio contact at the same time flying a triangular pattern, a procedure used by, among others, NATO aircraft and intended to draw the attention to those watching on the radar to the aircraft's difficulty. In this instance it was not followed quite correctly. There was in any case no response.

The pilot then descended through a clearance in the clouds over the sea. He found a cloud base of 500 feet with poor visibility below and decided that the safest course of action was to ditch near a trawler. This operation was carried out neatly and successfully.

2.2 Conclusions

(a) *Findings*

(i) The aircraft's documents were in order and it was properly loaded.

(ii) The aircraft had been maintained in accordance with an approved maintenance schedule.

(iii) The pilot was properly licensed and adequately experienced.

(iv) Whilst flying in visual meteorological conditions above cloud over The Netherlands a failure of the electrical supply caused a loss of all radio and navigational equipment.

(v) The pilot elected to return towards the English coast above cloud in the hope of finding weather suitable for a visual let-down.

(vi) In the event the weather over eastern England proved to be unsuitable for a visual descent and the pilot had to descend in a gap in the clouds over the sea.

(vii) Because of low cloud and mist the pilot considered it unsafe to fly over land and decided to ditch near a trawler.

(viii) The ditching operation was well executed.

(ix) It was not possible to determine the cause of the electrical failure.

(b) *Cause*

The accident stemmed from the failure of the electrical supply in the aircraft, the reason for which has not been determined, and the decision of the pilot to ditch the aircraft as he considered it unsafe to attempt flight over land without navigational aids in the weather prevailing at the time.

G M Kelly
Inspector of Accidents

Accidents Investigation Branch
Department of Trade and Industry
December 1971

R 6782 Dd 502281 K7 1/72 C