ACCIDENTS INVESTIGATION BRANCH
Department of Trade

Piper PA 34 Seneca G-BBFF
Report on the accident at Machrins airstrip, Colonsay Island, Argyllshire, Scotland on 25 May 1974

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List of Civil Aircraft Accident Reports issued by AIB in 1974

No.	*Short title*	*Date of publication*
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2/74	Piper PA 30 Twin Comanche G-AXRW at Shipdham Aerodrome, Norfolk, January 1973	April 1974
3/74	Slingsby T61A G-AYUO near Wycombe Air Park, Bucks., February 1973	May 1974
4/74	Viscount 802 G-AOHI at Ben More, Perthshire, Scotland, January 1973	May 1974
5/74	Owl Racer 65-2 G-AYMS at Greenwich Reach, River Thames, London, May 1971	May 1974
6/74	British Caledonian Airways BAC 1-11 at Corfu Airport, Greece, July 1972	May 1974
7/74	Wallis WA-117 Autogyro G-AXAR at Farnborough, Hants., September 1970	January 1975
8/74	AA-1 Yankee G-AYHD at Beverley Nursery, near Uxbridge, Middlesex, April 1973	July 1974
9/74	Cessna F172H G-AYDC near Humphrey Head, Lancashire, December 1972	June 1974
10/74	Beagle A.61 Series 2 (Terrier) G-ARZT near Tonbridge, Kent, August 1973	July 1974
11/74	Beagle A.61 Series 2 (Terrier) G-ATMS near Saltby, Leicestershire, August 1973	July 1974
12/74	Piper PA-30 (Twin Comanche) G-ASLD at Newchurch, Isle of Wight, May 1972	August 1974
13/74	Tiger Moth G-APVT and Rollason Beta G-ATLY at Nottingham Airport, September 1973	January 1975
14/74	Cessna F172H G-AVHI in the sea 44 nm east of Wick, Scotland, December 1973	October 1974
15/74	AESL Airtourer T6/24 G-AYMF near Lands End, Cornwall, June 1972	September 1974
16/74	Piper PA 28-140 G-AVBM near Dursley, Gloucestershire, August 1973	September 1974
17/74	Avions Pierre Robin DR 360, Robin Knight G-AZOX at Biggin Hill Aerodrome, Kent, July 1973	November 1974
18/74	Piper PA 23-250E Aztec G-AZIF near Great Sampford, Essex, January 1972	November 1974

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No.	*Short title*	*Date of publication*
19/74	Chipmunk DH C1 Series 22A G-ARCR at Windlesham, Surrey, September 1973	November 1974
20/74	Jodel D117 G-ZFK at Doncaster Aerodrome, April 1973	December 1974
21/74	Societe Aeronautique Normande Jodel D117 G-AVEI at Brixham, Devon, September 1973	January 1975
22/74	Rollason Condor DB62B G-ATSK near Fairoaks Aerodrome, July 1973	February 1975

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Department of Trade
Accidents Investigation Branch
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London WC2R 0DP

17 December 1974

The Rt Honourable Peter Shore MP
Secretary of State for Trade

Sir,

I have the honour to submit the report by Mr P J Bardon, an Inspector of Accidents, on the circumstances of the accident to Piper PA 34 Seneca G-BBFF which occurred at Machrins airstrip, Colonsay Island, Argyllshire, Scotland on 25 May 1974.

I have the honour to be
Sir
Your obedient Servant

W H Tench
Chief Inspector of Accidents

Accidents Investigation Branch
Civil Aircraft Accident Report No 23/74
(EW/C488)

Aircraft:	Piper PA 34 Seneca G-BBFF
Engines:	Two Lycoming 10-360-CIE6
Operator:	Airgo Ltd
Registered Owner:	American Airspeed Incorporated Limited
Pilot:	Mr J A Spiers – Uninjured
Passengers:	Two – Uninjured
Place of Accident:	Machrins airstrip, Colonsay Island, Argyllshire, Scotland
Date and Time:	25 May 1974 at approx 1640 hrs
	All times in this report are GMT

Summary

The aircraft had made a Visual Flight Rule (VFR) charter flight from Oban to a landing strip on Colonsay Island. On landing, the aircraft ran off the grass runway onto rough ground and the nose gear collapsed. The aircraft sustained further damage on collision with a boulder. There were no injuries to the three occupants.

The report concludes that the accident was caused by the pilot misaligning his approach which resulted in the aircraft landing across the runway and encountering rough ground.

1. Investigation

1.1 History of the flight

The aircraft had been chartered to fly a passenger from Oban (North Connel), to Machrins airstrip on Colonsay Island. It left Glasgow where it was normally based, with one passenger, and flew without incident to Oban where the other passenger was embarked. As the weather conditions were suitable for VFR, no flight plan was filed for the leg to Colonsay.

The aircraft took off from Oban at 1620 hrs and arrived over Colonsay at 1636 hrs. As there was no communication with the ground the pilot estimated the surface wind whilst he was circling the field, as being north west at 5 to 10 knots from a smoke marker situated on the north side of the single grass strip, the direction of which was $290^{o}/110^{o}$ magnetic. Smoke from the marker was therefore drifting across the strip. During the later stages of the approach to Runway 29 which was made over low lying hills and also into sun, it became apparent to the passenger in the second row of seats, that the aircraft was not aligned with the strip. She shouted a warning to the pilot that the strip was to the right, but this was unheard. The aircraft then touched down approximately half way along the runway, but at an angle of about 15 degrees to it. The pilot realised almost immediately that he was not properly aligned and took over-shoot action just as the aircraft ran off the left hand side. However, the aircraft did not become properly airborne before it encountered undulating ground which caused the nose landing gear to collapse. The aircraft then struck a large stone boulder which broke off the right wheel and severely damaged the right wing. The aircraft subsequently ground looped and came to rest. None of the three occupants were injured and they were able to leave the aircraft through the normal exit on the right side. There was no fire although the fuel tanks were ruptured and the aircraft was severely damaged.

1.2 Injuries to persons

None

1.3 Damage to aircraft

Severely damaged

1.4 Other damage

None

1.5 Crew information

1.5.1.

Commander:	Mr John Alexander Spiers, aged 46
Licence:	Airline Transport Pilots Licence as pilot in command on DHC 1, BN 2 Islander, PA 23 & PA 34.
Medical validity:	Until 31 October 1974
Licence validity:	Until 10 April 1977
Flight R/T licence	Restricted

Instrument rating validity:	Until 30 June 1975
Total flying experience:	4,474 hours 45 minutes
Hours in command on type:	80 hours 20 minutes
Hours in last 28 days prior to accident:	29 hours 40 minutes
Hours in type last 28 days:	10 hours 40 minutes

It was not possible to establish at the time of the investigation whether the Certificate of Test for the PA 34 contained on the pilot's licence was properly valid.

The pilot had flown into the Machrins strip once before on 2 May 1974 when he landed and took off from west to east. However he had flown into a large number of strips both in the UK and overseas.

1.6 Aircraft information

	Piper PA 34 Series 200-2	G-BBFF
1.6.1.	Manufacturer:	Piper Aircraft Corporation (USA)
	Date of manufacture:	7 June 1972
	Certificate of Registration:	The aircraft was registered in the name of the American Airspeed Incorporated Ltd in August 1973 but an application had been made for a transfer of registered owner to Airgo Ltd by 29 August 1974 but the formalities had not been completed at the time of the accident.
	Certificate of Airworthiness:	General Purpose Category valid until 22 August 1975. The aircraft had been maintained in accordance with an aircraft maintenance schedule approved by the Civil Aviation Authority (CAA)
	Total hours since built:	390
	Hours since last check:	13.40
	Maximum weight allowed:	4,200 lb
	Estimated Accident weight:	3,400 lb
	Permitted C of G range at accident weight:	82" to 95" aft of datum
	Accident C of G:	87" aft of datum
	Type of fuel:	AVGAS 100 Octane

1.7 Meteorological information

An aftercast prepared by the Prestwick Airport Meteorological Office of the weather at Colonsay Island between 1600 hrs and 1700 hrs on 25 May 1974 is as follows:

Surface wind:	North Westerly 10 knots
Visibility:	15 kilometres, occasionally 3 kilometres
Weather:	Occasional drizzle
Cloud:	6/8 Strato Cumulus at 3,000 feet, occasionally 5/8 Stratus at 500 feet.
Temperature:	12°C.

1.8 Aids to navigation

There were no radio navigational aids on Colonsay Island.

1.9 Communications

The en-route communications between G-BBFF and the ground stations were normal after leaving Glasgow Airport. There is no air/ground radio communication at Colonsay Island.

1.10 Aerodrome and ground facilities

1.10.1 *Colonsay airstrip history*

The unlicensed airstrip at Machrins farm on Colonsay Island was constructed in 1968 by the Royal Engineers under 'Operation for Military Aid to the Community' (OPMAC). To allow the project to proceed the task was sponsored by the Argyll County Council in co-operation with the Board of Trade on the basis that the strip could be used by the Scottish Home and Health Department for their Air Ambulance aircraft. To reduce costs, the strip was prepared to the minimum acceptable standards using the maximum permissible gradients, both transverse and longitudinal. The final removal of obstructing rock outcrops was completed in March 1972. The CAA publication 'Air Transport in the Scottish Highlands and Islands' dated March 1974 lists 'COLONSAY' as 'a private airstrip – not yet completed'. However, since September 1973 at least 3 aircraft had landed on the strip before the accident flight, all without incident, including the flight by the pilot on 2 May 1974.

1.10.2 *Characteristics of the runway*

The strip enclosed a single grass runway orientated 290°/110° magnetic, 553 metres in length and 27.4 metres wide. The runway was marked on each side by 8 concrete slabs flush with the surface and painted white, each 1.82 by 0.6 metres (6 by 2 ft) in size spaced up to a maximum distance apart of 91 metres (300 ft). An additional marker of the same type was positioned at the threshold of Runway 29 close to the wire boundary fence. There was no threshold marker at the end of Runway 29 and the grass surface continued with a marked downslope for 105 metres to the strip boundary.

Although the markers could be seen clearly from directly overhead, they became progressively less visible with decreasing height on the approach. This was partly due to the undulations in the ground and also because each marker was flush with the surface and below the level of the surrounding grass and thistles. On the runway itself, which consisted of newly seeded grass, there were a considerable number of loose stones. No windsock was provided; the surface wind direction being indicated on this occasion, by a

smoke marker. At the time of the accident this had the effect of reducing visibility over part of the runway.

1.10.3 *Landing field lengths*

The required landing distance on a dry grass runway for the estimated aircraft weight and weather conditions on the day of the accident extracted from the Piper PA 34-200 Seneca Flight manual, page 99 were as follows:-

5 knots headwind, landing distance – 567 metres
10 knots headwind, landing distance – 534 metres

1.10.4 *Rescue and emergency services*

There was no requirement for fire fighting or rescue equipment, and none was available. However, at the time of the accident, a doctor was present at the strip.

1.11 Flight recorder

Not required and not fitted.

1.12 Wreckage

The aircraft came to rest 41 metres south of the runway and close to the southern boundary fence. From an examination of the wheel marks, it could be seen that the aircraft had left the runway 396 metres from the threshold at an angle of 15°. During its passage across the rough ground after it left the runway the aircraft received damage to its fuselage, engine nacelles and propellers. The nose landing gear had collapsed and the right wing fractured on collision with a stone boulder which also demolished the right main landing gear. The area was contaminated by fuel following fracture of the right tank and emptying of the left tank due to the cockpit fuel selectors being left in the crossfeed position.

The cockpit controls were found as follows:

Throttle:	Fully open – friction control, half on
Mixture levers:	Both to fully lean position
R P M levers:	Both to fully decrease, rear position
Fuel selectors (both):	Set to crossfeed
Magnetos:	Both engines to Off
Altimeters:	Captain's side 1,020.5 mbs Co-pilot's side 1,024 mbs
Electrical master switch:	On
Alternators:	Both on
Navigation and landing lights:	Off
Anti-collision light:	Off
Pitot heat:	Off

Fuel pumps:	Off
Flap selector:	Up position
Landing gear selector:	Down
Cabin heater:	Off

1.13 Medical and pathological information

None

1.14 Fire

There was no fire

1.15 Survival aspects

The aircraft was fitted with shoulder harnesses and lap straps for the front seats and lap straps only for the rear seats. No injuries were sustained by the pilot and passengers and their lap straps were secured at the time of the accident, but the shoulder straps were not fastened. The survival of the occupants was due largely to the absence of post crash fire of which there was a serious risk following spillage of high octane fuel. There was no pre-flight safety briefing given to the passenger who embarked at Oban regarding the use of lap straps or exits.

1.16 Tests and research

None

1.17 Other information

1.17.1 *Operation of Unlicensed Aerodromes and Airstrips*

A Memorandum, DAS 1/74, was issued in February 1974 by the Directorate of Aerodrome Standards, CAA, to provide guidance to the owners and managements of unlicensed aerodromes and airstrips as to the measures that should be taken to ensure the safety of the occupants of aircraft and members of the public. The following extracts from the Memorandum are relevant to this accident:-

SAFETY STANDARDS AT UNLICENSED AERODROMES (Page 1)

The responsibility for ensuring that a flight may be undertaken safely and in compliance with the safety regulations lies with the operator and pilot of an aircraft. However, managements at unlicensed aerodromes should ensure that the facilities provided are such that will enable the pilot to comply with his legal responsibilities.

GROUND SIGNALS AND AERODROME MARKING (Page 3)

Before landing or taking-off a pilot needs to know the wind speed and direction and the position of the boundaries of the area within which it is safe to carry out these manoeuvres.

A wind-sleeve should be located adjacent to the main strip where wind speed and direction are representative of the wind conditions on the strip itself. The site should not be close to buildings, trees or very undulating ground. To make it conspicuous the wind-sleeve position should be marked on the ground by a white circle, 25 feet in diameter and 2 feet wide.

The lateral boundaries of a grass runway should be shown in white flat rectangular markers 10 feet long and 3 feet wide at intervals not exceeding 300 feet, and flush with the runway surface. Alternatively, suitable elevated markers such as cones at the same intervals may be used provided they are frangible. The ends of a grass runway should be indicated by similar markers placed at right angles to and adjoining the lateral markers. Where operations are not confined to marked unpaved runways, and landing may be made in the direction of the wind, the limits of the useable area should be marked in the same way.

OBSTRUCTIONS

Any object or structure which by reason of its height or position may be a hazard to landing or taking-off and which cannot be removed should be painted or marked to make it conspicuous.

FIRE FIGHTING AND RESCUE EQUIPMENT (Page 5)

The following should be provided:

(i) A vehicle or vehicles with cross-country capability should be available, capable of carrying the personnel and equipment, either on the vehicle or in a trailer connected to the vehicle.

(ii) A foam extinguisher, containing 20 gallons of an aqueous solution of a fluorochemical or fluoroprotein extinguishing agent, with a discharge rate not less than 15 gallons per minute through one or more hose lines should be available on the vehicle.

(iii) Rescue equipment, consisting of:

1 Axe, preferably one designed for cutting metal
1 Bolt Cropper
1 Crowbar
1 Hacksaw, complete with two spare blades
1 Pair of Pliers
1 Knife, preferably a harness knife, with sheath
1 Pair Flame Resistant Gloves (if not issued to crew members on a personal basis)
1 Flame Resistant Blanket

2. Analysis and Conclusions

2.1 Analysis

It is apparent from the evidence that the accident happened because the pilot did not realise that he was misaligned with the strip on his approach to land and in the consequence, landed across it. Once the aircraft had run off the side of the strip, the surface of the ground was too rough for the attempted overshoot to be successful and the aircraft started to break up.

There were a number of factors which all contributed to the accident. The first of these was the type of runway marking used which made it difficult to identify the correct line to fly the approach. This was because the markers themselves were partly obscured at shallow angles of approach not only by surrounding grass and thistles, but also by being widely spaced on an undulating surface. Though the standard of marking largely met the requirements of the DAS Memorandum 1/74, it was clearly unsuited to the type of surface on the Colonsay airstrip. Some other type of elevated marking, also recommended by the Memorandum, would have obviously been preferable, as would closer spacing between individual markers.

The second factor which undoubtedly contributed to the pilot's difficulties in correctly aligning the aircraft on the approach was that he was flying into sun, an effect which was further aggravated by the smoke from the wind indicator drifting across the runway. The lighting of a smoke marker to indicate the direction of the surface wind to the pilot was obviously well intended by those on the ground, but they failed to appreciate the necessity of placing the marker on the leeward side of the runway. The provision of a windsock, which is recommended by the DAS Memorandum is clearly preferable to smoke indicators.

Though conditions on the ground were clearly less than ideal, the responsibility for accepting them must rest with the operator of the aircraft and the pilot. The pilot had visited the strip once before a few weeks earlier, but he had not reported to his company at the time that he considered the strip to be in any way unsuitable. However on that occasion, he apparently did not make a full inspection of both approaches, and in the circumstances, it would have been prudent before attempting an approach to Runway 29, with which he was unfamiliar, to have made a low pass in the intended landing direction to assess the difficulties.

The DAS Memorandum previously referred to recommends a scale of fire fighting and rescue equipment for unlicensed aerodromes and airstrips, and though this is not mandatory, there is clearly some obligation on the part of the management of such strips to make provision for rescue and fire fighting, particularly where commercial operations were involved. At Colonsay there was no equipment whatever and it was thus entirely fortuitous that a post crash fire, of which there was a high risk, did not occur. Had it done so, there was nothing that those on the airfield could have done to contain it in order to rescue the occupants of the aircraft had they been trapped.

2.2 Conclusions

(a) *Findings*

(i) The pilot was adequately experienced for the flight. The validity of the pilot's licence at the time of the accident was not established.

(ii) The weight of the aircraft at take-off and the landing was less than the maximum authorised, and the centre of gravity was within the required limits.

(iii) The landing distance available was just equal to that required by the aircraft in the prevailing circumstances.

(iv) The aircraft had been maintained in accordance with an approved maintenance schedule and the documentation was in order.

(v) The pilot had no previous experience of the approach and landing to Runway 29 at Machrins Airstrip, Colonsay Island.

(vi) The Machrins Airstrip had considerable gradients both laterally and longitudinally.

(vii) The runway markers were difficult to locate on the approach due to surrounding vegetation and being widely spaced.

(viii) The forward visibility on the approach was affected by the sun and smoke haze.

(ix) The pilot misaligned the aircraft on the approach and landed across the runway.

(x) The aircraft was damaged when it ran off the left side of the runway and encountered undulating ground and a large stone obstruction.

(xi) No pre-flight safety instructions were given to the fare paying passenger.

(b) *Cause*

The accident was caused by the pilot misaligning his approach in adverse circumstances which resulted in the aircraft landing across the strip and encountering rough ground where it broke up.

P J Bardon
Inspector of Accidents

Accidents Investigation Branch
Department of Trade

December 1974

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