ACCIDENTS INVESTIGATION BRANCH
Department of Trade and Industry

AA - 1 Yankee G-AYHB

Report on the accident at Preesall, near Blackpool, Lancashire on 1 January 1971

LONDON: HER MAJESTY'S STATIONERY OFFICE
1971

List of Civil Aircraft Accident Reports issued by AIB in 1971

No.	*Short title*	*Date of publication*
1/71	Hawker Siddeley HS 748's G–ATEK and G–ATEH at Portsmouth, August 1967	March 1971
2/71	Aeronca C100 G–AETG at High Wycombe, April 1969	March 1971
3/71	Super Constellation BG 579 and Boeing 727 SX–CBB at Heathrow, January 1970	March 1971
4/71	Boeing 720 4X–ABB and Vickers VC 10 G–ASGD over Epsom, November 1969	March 1971
5/71	Beagle B 121 G–AXIB at Blackpool, May 1970	March 1971
6/71	Vickers VC 10 G–ASGK near Reading, November 1969	April 1971
7/71	Jodel DR 250 G–AVIV at Carnedd Dafydd, August 1969	June 1971
8/71	Chipmunk DH C 1 G–AOTH at Fawley, February 1970	July 1971
9/71	Piper PA 28 Cherokee 140 G–AVBN at Ruxley, August 1970	July 1971
10/71	Hawker Siddeley HS 104 Dove G–AVHV, near Wolverhampton, April 1970	July 1971
11/71	Sikorsky S–6IN G–ASNM 50 n.m. east of Aberdeen, November 1970	September 1971
12/71	AA-1 Yankee G-AYHB at Preesall, January 1971	September 1971

SBN 11 510641 3

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

June 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 on the circumstances of the accident to AA–1 Yankee G–AYHB which occurred at Preesall, near Blackpool, Lancs, on 1 January 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/C/369

Aircraft:	AA–1 Yankee G–AYHB
Engine:	One Lycoming 0–235–C2C
Registered Owner:	General Aviation Sales, Jersey
Operator:	Air Navigation and Trading Co Ltd Flying Club, Blackpool
Crew:	Instructor – R J Turner – killed Student – J H Smith – killed
Passengers:	Nil
Place of Accident:	Preesall, Nr Blackpool, Lancs
Date and Time:	1 January 1971 at 1535 hrs. All times in this report are GMT

Summary

The accident occurred during a local instructional flight from Blackpool airport. About twenty minutes after take-off the aircraft was seen flying some ten miles north of Blackpool at about 3,000 feet; its engine was running normally. Shortly after turning on to a southerly heading the aircraft went into a righthand spin. After some six turns of the spin there was an apparent attempt to recover but it was unsuccessful and the aircraft began to spin again in the same direction. Three or more turns were observed before the aircraft went out of sight. It was found to have struck the ground in a nose-down attitude, in a manner consistent with having been spinning to the right. Both the occupants were killed and the aircraft was destroyed but there was no fire.

1. Investigation

1.1 History of the flight

The purpose of the flight was to give the student pilot some revision in stalls, steep turns, and simulated forced landings before taking a general flying test. The accident occurred in an area which had been designated by the club for carrying out such exercises.

The instructor booked out by telephone to Air Traffic Control (ATC) for a 30 minute detail in the Yankee G–AYHB.

The aircraft was fuelled to full capacity and cleared at 1510 hrs to taxy to the holding point. The instructor occupied the right hand seat and the student the left; both were secured by lap-straps. After taking-off at 1515 hrs from Runway 14 the aircraft turned left and flew towards the north. Four minutes later the student, who had made all the previous R/T calls, informed ATC that the aircraft had cleared the circuit. There were no further communications.

Witnesses saw the aircraft flying in the Preesall area at an estimated height of about 3,000 feet, on a northerly heading with its engine running normally. It then turned right through about 180° and flew south. A few seconds later the engine noise decreased, as though it had been throttled back, and the aircraft's nose was seen to rise. Almost immediately the right wing dropped and the aircraft began to spiral towards the ground with its nose down almost vertically. The spiral tightened into a spin in a clockwise direction. After about six turns of the spin there appeared to be an attempt at recovery, rotation stopped momentarily, the nose lifted until it was about 30° below the horizon and engine power came on. However, instead of recovering, the aircraft began to spin again in the same direction, but with the nose not quite so low. During this time the engine was again throttled back. After at least three more turns of the spin the aircraft went from view behind a hill 50 feet high. It struck the ground in a grass field on the slope of the hill, in a steep nose-down attitude.

Only two witnesses saw the aircraft enter the spin from normal level flight. One of these had had instruction to the standard of a private pilot's licence and said that the aircraft was high enough, initially, to do aerobatics. Consideration of witnesses' estimates of height and the number of turns of the spin supports the view that aircraft was at about 3,000 feet when the spin began.

1.2 Injuries to persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal	2	–	–
Non-fatal	–	–	–
None	–	–	–

1.3 Damage to aircraft

Destroyed.

1.4 Other damage

Nil.

1.5 Crew information

1.5.1 The Instructor Roderick John Turner, age 24, held a valid private pilot's licence for Group A aeroplanes and a full flying instructor's rating excluding all aerobatics except spinning. He learned to fly with the Luton Flying Club in May 1964. In December 1968 he became an assistant flying instructor with the Aeromart Flying Club, Blackbushe and completed 90 hours instructing experience. He was then employed as a full time flying instructor in July 1969 by the Air Navigation and Trading Co Ltd Flying Club, Blackpool. The Chief Flying Instructor (CFI) rated Mr Turner's flying and instructional ability as high. He was also highly regarded by his pupils, although he was strict and required them to be meticulous in all their checks. Up to the time of the accident he had completed over 1,400 hours instructing and his logbooks showed he had accumulated a total of approximately 1,815 hours flying including 20 hours 45 minutes on the Yankee.

One of the three students to fly with Mr Turner on the day of the accident thought that the instructor was a little pre-occupied because he had not noticed, until afterwards, two omissions in the flight checks which was most unusual for him. The other two students had noticed nothing unusual in his demeanour. The postmortem examination revealed no medical condition that could have had a bearing on the accident.

1.5.2 The Student John Hampson Smith, age 19, who held a student pilot's licence, joined the Air Navigation and Trading Co Ltd Flying Club in August 1970. He had completed the course for a private pilot's licence, with the exception of a solo cross-country. His total flying time amounted to 36 hours and included 11 hours 55 minutes solo flying. His experience on the Yankee amounted to 4 hours 40 minutes of which 3 hours 05 minutes was solo flying. The Chief Flying Instructor (CFI) reported that he had made good progress during the course and he was above average as a student pilot but inclined to be 'sloppy' about his checks.

The postmortem disclosed no medical abnormality.

1.6 Aircraft information

The AA–1 Yankee is a side by side two seater, all metal, low-wing monoplane, with a fixed tricycle undercarriage. It is powered by a four cylinder horizontally opposed 108 horsepower Lycoming engine driving a fixed-pitch metal propeller.

A unique metal to metal bonding process, used in the airframe construction, eliminates rivets and provides the aircraft with smooth aerodynamic surfaces. The tubular main wing spar also serves as a two-cell fuel tank, with each cell holding 10 imperial gallons of usable fuel or 11 gallons total fuel.

Yankee G–AYHB was constructed by the American Aviation Corporation, Cleveland, Ohio, in May 1970 and was issued with a United States of America certificate of airworthiness on 26 June 1970 for the normal and utility categories with an endorsement stating that the aircraft was not certified for spinning in either category. After being shipped to the United Kingdom it was reassembled and air-tested on 14 August 1970. The aircraft had a valid United Kingdom certificate of airworthiness (C of A) in the transport category and had been properly maintained in accordance with an approved maintenance schedule. The C of A required that the aircraft should be operated to the American Yankee Owners Manual.

G–AYHB had flown a total of 123 hours 30 minutes up to the time of the accident. Before take-off on the subject flight the aircraft was refuelled with 11 gallons of 80 octane which filled both tanks to capacity. At take-off the weight of the aircraft was 7 lb below its maximum permissible all-up weight and the C of G was 1.7 inches forward of the aft limit.

1.7 Meteorological information

The weather was fine and had no bearing on the accident.

1.8 Aids to navigation

Not applicable.

1.9 Communications

Communications between the aircraft and air traffic control were normal.

1.10 Aerodrome and ground facilities

Not applicable.

1.11 Flight recorder

Not fitted, and not required to be fitted.

1.12 Wreckage

Inspection at the scene of the accident showed that the aircraft had struck sloping ground at the edge of a grass field, below a small hill 50 feet amsl.

Impact marks from the leading edges of the wings indicated it had struck in a steep nose-down attitude of between 45° and 60° on a heading of 076°M. The general features of these marks and the nature of the structural break-up were consistent with the aircraft having been in a righthand spin. This is supported by the fact that oil from the engine breather had been sprayed onto the port side of the fuselage and tail.

The forward part of the structure, including the power unit and cockpit area, was severely crushed by the impact, but no fire occured.

The settings of the throttle and mixture controls on the engine had been disturbed by the impact with the ground but the throttle lever in the cockpit was found in the closed position and the damage it had received indicates that it was in this position at impact.

The carburetter heat control was in the 'cold' position. Inspection of the fuel and oil filters showed them to be clean. Because of damage to the carburation and ignition systems they could not be tested but examination revealed no evidence of pre-crash failure. The condition of the propeller indicated the engine was running under a degree of power at the time of impact. The flying control system had been completely disrupted but examination showed that it had been intact at the time of the accident. The condition of the flaps actuating motor indicated that the flaps were fully retracted at the time of impact.

The lap-straps of the two occupants were fastened but the attachments had failed on impact.

1.13 Fire

There was no fire.

1.14 Survival aspects

The accident was not survivable.

1.15 Tests and research

Spinning tests were carried out in the United States of America by the American Aviation Corporation and by the Federal Aviation Administration (FAA) for certification purposes. No spin test was authorised or carried out for more than a one turn spin. Recovery was initiated at the end of the first turn. During the certification testing the AA–1 spin modes were investigated for various combinations of entry conditions, control positions, C of G location, power settings, and fuel load, including adverse assymetrical fuel loading. The results of this flight testing showed that no adverse spin characteristics were found. The aircraft recovered from the spin in less than one additional turn. However, the FAA have stated that "since no investigation beyond one turn is made, it may be possible for an airplane to progress into an unrecoverable spin, if recovery is not initiated immediately, while not exhibiting this characteristic during the one turn spin testing".

The Air Registration Board carried out a flight test of an AA–1 Yankee aircraft on 13 July 1970 for type approval and certification of the first aircraft on the United Kingdom register. The flight was made at virtually maximum weight with the C of G within ½ inch of its aft limit. No spinning was carried out.

The only significant comments from the test report were that although the aircraft was lively and pleasantly 'skittish' the dynamic directional stability was weak and the aircraft 'snaked' readily. It was thought considerable improvement might result from the fitting of a ventral fin but it was understood that the manufacturer intended to lengthen the rear fuselage on subsequent models.

1.16 Handling characteristics

Although the aircraft was not certificated for spinning, the instructor involved in the accident had in fact spun G–AYHB on 11 September 1970, shortly after it was delivered new to the club. His purpose was to check the spinning characteristics so as to be able to recover control in the event of an inadvertent spin by a pilot under training at low level. Afterwards he informed the CFI that the spin and recovery action was similar to that of the Chipmunk. The qualified pilot who accompanied the instructor on this flight said that only one spin was carried out, he thought to the right, and that it was initiated at 5,000 feet. Recovery action was taken after three or four turns and it took about 2½ further turns to stop the spin. From start to finish including the pull out from the ensuing dive 3,000 feet was lost. The standard recovery action was used ie full opposite rudder then the control column slowly forward, but rotation did not stop until the control column was nearly fully forward. The pilot was impressed by the amount of height lost and the need for the correct and full spin recovery action. Several stalls were also carried out and about 300 feet of height was lost in recovering from each stall.

A qualified flying instructor on light piston-engined aircraft who flew the Yankee for the first time with another instructor, reported that in the stall, with and without flaps, and without power, there was no tendency for a wing to drop. The stall was positive but gentle and recovery action was immediate and easily affected with little loss of height. He reported that the aircraft's handling was very sensitive, particularly the elevator, which was very light and very effective right down to touch-down. An extract from his report concerning the handling of the Yankee is worth noting:

> 'Next, at about 2,500 ft agl and with the aircraft trimmed for level cruise at 105 mph I tried stalling in the steep turn, entering the turn from cruise with part throttle. The first, which was to the left, produced a reasonably marked judder and recovery was immediate on releasing the backward pressure on the control column. The second, which was to the right, produced a similar judder immediately followed by a rapid flick to the right into a near inverted attitude. The control column was not, I think fully aft and I believe the turn was balanced or reasonably so. I released the backward pressure and applied part left rudder. Again the recovery was immediate but this time the aircraft immediately flicked to the left into a nearly erect but somewhat nose-down attitude. I again checked the stall with simultaneous application of right rudder and release of backward pressure. However, I probably re-applied backward pressure to ease out of the dive as soon as the stall appeared to have been checked on this and the previous occasion. In any case, the aircraft then flicked for the third

time, this time to right and again to the nearly inverted attitude with the nose well down by this time, possibly about 20° below the horizon. It then belatedly occurred to me that it was especially necessary on this type to centralise the rudder *immediately* on recovery and to make a positive forward movement of the control column, whilst being in no hurry in re-applying backward pressure, if one were to prevent a second-phase accelerated stall. I think that there must have been one more flick before I regained full control by this method because the aircraft finally settled into a moderately steep nose-down but erect attitude from which it was only necessary to ease gently out of the ensuing dive with about cruising speed indicated'.

The lose of height during this occurence was, he thought, about 1,000 feet.

2. Analysis and Conclusions

2.1 Analysis

There is no doubt that the accident was the result of a failure to recover from a spin. There is no evidence to indicate that the spin or the failure to recover from it was the result of a failure or malfunction of the aircraft or its controls. This implies that the spin was pilot induced, so it has to be considered whether the spin was deliberate or inadvertent. There are a number of circumstances that argue against a deliberate spin. The Yankee, which is light on the controls and lively in performance, is not certificated for spinning. This indicates it does not necessarily meet the airworthiness requirements for spin recovery.

The instructor had in fact spun the aircraft on a previous flight and must have been as impressed as the qualified pilot who accompanied him was by the length of time the aircraft took to recover, and the amount of height that was lost in doing so.

The height at which the aircraft was seen to go into a spin during the accident flight is assessed, albeit, rather roughly, from the witnesses' evidence as being about 3,000 feet. It can be argued that this was high enough to have initiated a spin deliberately, but since 3,000 feet was the height lost during the recovery from the spin on the earlier flight it is unreasonable to suppose that the instructor would deliberately spin the aircraft at this height, especially with a pupil. It would have been an act of recklessness quite out of character.

It is therefore concluded from the evidence on this point, that the spin was not deliberate. Although it is uncertain who was flying the aircraft when the spin began, the probability is that the pupil was practising a stall when he inadvertently let the aircraft go into a spin before the instructor could prevent it. The available evidence indicates that the aircraft will go into a spin if handled coarsely, especially near the stall, and that should it spin it would need a good deal of height and precise handling to effect a recovery. Pilot opinion of the handling of the aircraft suggests strongly that in certain circumstances it could go into a spin quickly enough to take the instructor unaware.

Once in a spin at this height the instructor, it may be supposed in view of his previous experience, would have been apprehensive about recovering in the height available. He appears in fact to have been almost successful. Rotation was stopped momentarily some distance from the ground, but recommenced, most probably because eagerness to pull out quickly from the ensuring dive led to overcontrolling. There remained insufficient height to recover from the second spin.

2.2 Conclusions

(a) *Findings*

(i) The documentation of the aircraft was in order.

(ii) The aircraft was properly maintained and correctly loaded.

(iii) No evidence was found of pre-crash failure or malfunction of the aircraft or its equipment.

(iv) The instructor was experienced and properly licenced.

(v) The aircraft was inadvertently allowed to go into a spin while a student pilot was practising stalls.

(vi) Over-controlling during an attempt to recover probably caused the aircraft to resume spinning and strike the ground.

(b) *Cause*

The accident resulted from the failure to recover from an inadvertent spin.

G M Kelly
Inspector of Accidents

Accidents Investigation Branch
Department of Trade and Industry
June 1971

R4057 Dd 502281 K6 7/71 P