AIRCRAFT ACCIDENT REPORT 1/83

Accidents Investigation Branch

Department of Trade

Report on the accident to Wasp Falcon IV Powered Hang Glider at Wittenham Clumps, near Didcot, on 21 May 1978

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Department of Trade
Accidents Investigation Branch
Bramshot
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GU13 8RX

1 March 1983

The Rt Honourable Lord Cockfield
Secretary of State for Trade

Sir,

I have the honour to submit the report by Mr D A Cooper, an Inspector of Accidents, on the circumstances of the accident to Wasp Falcon IV Powered Hang Glider at Wittenham Clumps, near Didcot, on 21 May 1978.

I have the honour to be
Sir
Your obedient Servant

G C Wilkinson
Chief Inspector of Accidents

Accidents Investigation Branch

Aircraft Accident Report No 1/83
(EW/C626)

Owner and Operator:	The pilot
Aircraft: Type:	Modified Wasp Falcon IV Powered Hang Glider
Nationality:	British
Place of Accident:	Wittenham Clumps near Didcot, Oxfordshire 51° 37′ N 001° 10′ W
Date and Time:	21 May 1978 at 1250 hrs
	All times in this report are GMT

Synopsis

The accident was notified to the Accidents Investigation Branch (AIB) on 21 May 1978 by the Thames Valley police. AIB was assisted by the British Hang Gliding Association (BHGA) and The Cranfield Institute of Technology (CIT) in carrying out the investigation.

The accident happened as the flight was being filmed. The pilot attempted a low pass manoeuvre along the north slope of Wittenham Clumps during the course of which the glider struck the ground and the pilot was killed.

The report concludes that the accident occurred because the pilot encountered an unexpected and violent nose-down pitch caused by a large rise in nett thrust when he increased power rapidly as he put the aircraft into a dive from a low level, there then being insufficient height for recovery. A contributory factor was the pilot's lack of experience on powered hang gliders.

1. Factual Information

1.1 History of the flight

In May 1978 the pilot purchased a Soarmaster power unit from the manufacturers in the United States of America and installed it on a Wasp Falcon IV hang glider, which he had previously modified for powered flight and experimented with using two less powerful engines. On Thursday 18 May, accompanied by a friend who had flown non-powered hang gliders, he took this machine to level ground for initial trials. Both pilots practised several short low hops to check the handling features and the power installation, and to practise using the mouth operated throttle.

On Friday 19 May the two went to a hang gliding site at Wittenham Clumps to carry out more extensive flight trials. Each pilot made one uneventful flight of about ten minutes, to about 1,000 feet. However, a third pilot, who had some powered hang glider experience, had a minor accident on take-off when the machine pitched nose-down and struck the ground. He attributed this to opening the throttle too quickly. In a statement following the accident the man who had shared the flight trials with the deceased pilot said that at the end of the day, while both of them felt that the glider possessed satisfactory basic stability, they considered that a number of additional test flights would be essential to ascertain the machine's entire flying characteristics under power.

The following day repairs were carried out to the control frame, keel boom and sail. These were completed to the satisfaction of the owner. For use as an alternative to the mouth operated throttle, a hand operated one was added, being mounted on the control frame.

On 21 May the pilot returned to Wittenham Clumps and, following a pre-flight check of the airframe and engine, took off into wind from the north facing slope. He climbed to 1,500 feet and completed several circuits, landing back at the launch area after a flight lasting some 15 minutes. Being satisfied with the aircraft's performance, the pilot agreed to make a low level circuit and flypast for a cine-photographer positioned just below the launch point. After refuelling and making another pre-flight check, the pilot launched the aircraft straight out from the hill into a light northerly wind and climbed to approximately 150 feet, where he levelled out and performed a wide 360 degree turn to the right (see Appendix 1). During this manoeuvre he was seen to use the hand throttle, although he still held the mouth operated one in place. At the end of this turn, flying into wind and under reduced power, the pilot removed his hands from the control frame for a few seconds without any apparent change in the attitude of the machine.

Continuing the flight into a second turn to the right the pilot was again seen to use the hand throttle whilst manoeuvring around the turn for about 270 degrees. This positioned the aircraft on a westerly heading and to the east of the launch area. The following description of the manoeuvre which culminated in the accident is based on the cine-film record (stills from which are at Appendix 2), and from eyewitness accounts.

The pilot was seen to initiate a dive from about 100 feet by pulling the control bar firmly towards himself and almost immediately the machine suddenly pitched violently nose-down. Coincidentally, a large increase in engine speed was heard. The machine then continued diving with the pilot's arms at full stretch grasping the control bar, and it struck the ground in a steep nose-down attitude. The pilot was killed. The engine was still running at a low speed but the propeller was not rotating. There was no fire.

1.2 **Injuries to persons**

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

1.3 **Damage to aircraft**

Substantial.

1.4 **Other damage**

Nil.

1.5 **Personnel information**

Pilot:	Male, aged 29 years
Licence:	None held and none required
Hang gliding background:	A member of the British Hang Gliding Association and the Thames Valley Hang Gliding Club
Total hang gliding experience:	87 hours 4 minutes recorded in the pilot's log-book
Powered hang gliding experience:	A number of flights during 1977, flying time not known
Experience on type:	35 minutes (estimated)
Hang glider experience in last 90 days:	18 hours 40 minutes
Weight of pilot plus harness and helmet:	147 lb (67 kg)

1.6 Aircraft information

1.6.1 History of aircraft

Falcon IV hang gliders were manufactured by Waspair Ltd of Croydon, Surrey who ceased trading in 1979. During 1977 the pilot, who was an agent of the company, approached it and suggested the joint development of a powered hang glider. Waspair was not enthusiastic about this project and the subject was dropped. However, later in the year the pilot asked the company for the use of a glider for powered flight development, and it was finally agreed that a second-hand prototype Falcon IV would be made available on permanent loan.

The Wasp Falcon IV was described by the manufacturer as being a hybrid Rogallo with very stable characteristics. It was fitted with a Varitrim unit which could be adjusted and then clamped so that the machine would be in trim for a particular pilot in a selected flight condition – for example, the prone position in cruising flight. In use, the Varitrim alters the effective point of harness attachment and therefore the position of the centre of gravity (C of G).

1.6.2 Comparison of the modified powered Falcon IV with the Waspair production Falcon IV B (See Appendices 3 and 4).

Type:	Modified Falcon IV	Production Falcon IV B
Date of Manufacture:	1976	1978
Nose Angle:	100 degrees	100 degrees
Leading edge length:	21 feet (6.4m)	21 feet (6.4m)
Effective keel length:	13 feet (4m)	14½ feet (4.4m)
Keel reflex:	7/8 inch (22mm) (equivalent to 1 1/8 inch (29mm) with a full length keel)	¾ inch (19 mm)
Keel camber:	3¾ inches (95mm)	3½ - 4 inches (88 - 102mm)
Leading edge camber:	8¼ inches (210mm)	8½ inches (216mm)
Leading edge reflex:	3 inches (76mm)	1¼ inches (32mm)
Vertical centre of gravity position: (with owner as pilot)	Approximately 34 inches (86.4cm) below the heart bolt	Approximately 39 inches (99.1cm) below the heart bolt
'Varitrim' horizontal centre of gravity adjuster position as found (distance 'G' Appendix 4)	7 inches (178mm)	Limits quoted in Pilot's Notes. 'Prone position: 0 to 3 inches (0 to 80mm) Seated position: 2 to 5 inches (50 to 150mm)'.

1.6.2 (cont)	Intersection of the thrust line and the control frame:	8 inches (203mm) below the keel tube	
	Weight of Soarmaster power unit:	39 lbs dry	
	Weight of hang glider:	53½ lb (24.27 kg) with instrument pack	50½ lbs (22.9 kg)
	Projected sail area:	182½ sq ft ($17.0m^2$)	200 sq ft ($18.6m^2$)
	All up weight of aircraft at take-off with owner as pilot:	242.5 lbs (110 kg)	

1.6.3 *Sail modifications*

During early development of the machine in 1977 Waspair, at the pilot's request, removed a portion of the keel and rear sail in order to accommodate the propeller and transmission shaft in a position which provided adequate clearance between the propeller disc and the pilot's feet. During subsequent flights that year the pilot noticed that the rear edge of the sail tended to flap and so he retrimmed the area adjacent to the keel. Measurement showed that the total area removed from the original sail was 17½ sq ft ($1.6m^2$) – (see Appendix 3).

1.6.4 *Power Unit*

In 1977 the pilot is believed to have experimented with two power units. One from a hedge cutter produced 18 lbs (8.16 kg) of thrust, and the other from a grass cutter produced 40 lbs (18.14 kg), and he made a small number of powered flights during that year. Apparently desiring greater thrust, the pilot then purchased a Soarmaster PP–106 power pack from the manufacturer in the United States. The PP–106 was designed as a 'bolt on' modification for hang gliders. It consisted of a two stroke 10 hp Chrysler engine with drive shaft, propeller and fuel tank, and was capable of producing 80 lbs (36.28 kg) of thrust. The mounting supplied with the unit had two fixing positions on the bracket for attachment to the rear keel position – a higher and a lower. The delivery package check list indicated that the higher position bracket had been supplied, however a fitting instruction sketch was also included which indicated that the lower position should be used. The pilot used the lower position, which resulted in a thrust line to keel angle of approximately 6 degrees (see Appendix 4), thereby placing the thrust line 2 feet 2 inches (66 cms) above the overall vertical centre of gravity with himself as pilot. The choice of the lower position was dictated by consideration of clearance between the shaft and the sail, and did not affect the position of the thrust line relative to the overall vertical centre of gravity. This relationship was determined by the forward attachment, which was effected as shown in the literature supplied with the Soarmaster unit.

The power unit was initially operated via a 'peg clip' type mouth throttle, and subsequently also had a hand throttle fixed on the left upright of the control frame which operated in parallel. The hand throttle could be set in any position and the mouth throttle would then have authority between this setting and full power, so allowing the pilot to vary power in this range without removing his left hand from the control bar. An ignition 'kill' button was mounted on the right upright of the control frame.

1.6.5 Airframe

Examination of the aircraft after the accident revealed no indication of gross error in either the modifications or the assembly of the machine, although some alterations to the rigging had been made which were outside the manufacturer's specifications recommended for the standard production Falcon IV. The Varitrim centre of gravity adjuster was found to be set outside the standard glider's nose-down limits, (See para 1.6.2). The Falcon has double deflexor tension cables fitted, (See Appendix 3). The lower of the two is to control the sail camber and the higher one to allow adjustment to the wing reflex. The tension of the reflex deflexor cables was greater than that recommended for the standard production aircraft.

1.6.6 Instruments

The glider was fitted with an instrument pack, containing an altimeter, airpseed and climb/descent indicators. The pack was attached to the left side of the control frame.

1.7 Meteorological information

An aftercast prepared by the Meteorological Office shows that anti-cyclonic conditions existed over the United Kingdom, producing a north-easterly pressure gradient over central and southern England, and a temperature inversion at 6,000 feet. The 1300 hrs meteorological observation taken at Benson, the nearest reporting station (about 5 miles from the accident site) was as follows:

Surface wind:	360°/5 to 10 knots
Visibility:	10 to 15 km
Significant weather:	Nil
Cloud:	5/8 2,000 feet
	7/8 5,000 feet
Temperature:	13°C

The accident occurred in daylight and light conditions were good. No significant turbulence was reported by the hang glider pilots using the site at the time.

1.8 Aids to navigation

Not applicable.

1.9 Communications

Not applicable.

1.10 Aerodrome information

Not applicable.

1.11 Flight recorder

Not applicable.

1.12 Wreckage and impact information

1.12.1 Site examination

Examination of the site (elevation 340 ft amsl) indicated that the aircraft had struck the ground with the apex of the sail and the left corner of the control frame almost simultaneously, approximating to a 40° nose-down attitude. On initial impact the forward part of the keel tube failed in compressive bending in two places, and both leading edge tubes were severely bent on their inboard portions. The aircraft then appears to have somersaulted over its apex, coming to rest inverted on a reciprocal heading. The Soarmaster power unit had suffered severe distortion of the bell housing and some impact damage to the front of the engine casing. The propeller was undamaged. The hand throttle was found to be set at one third to half open at the time of impact.

1.12.2 Detailed examination

The aircraft was taken to the AIB facility at Farnborough for detailed examination. The sail was removed and found to have suffered only minor tearing around its attachment points and in the various tube pockets. It was then laid out and measured, revealing that the original sail area had been reduced by about 17½ sq ft (1.6m^2) or 8¾%. All sail area which had been removed was from the centre trailing edge, in the reflex area. The frame of the aircraft was rebuilt using new production tubes, and the rigging from the accident aircraft.

As the rear portion of the accident aircraft's keel tube had been shortened to accommodate the Soarmaster power unit the rigging of the keel could not be measured in the normal way. The rigging dimensions were checked with the assistance of the manufacturer, and it was established that the leading edge tubes had more than twice the recommended reflex advised for the standard machine, although the camber was about normal. The keel had been reflexed 50% more than standard.

Examination of the engine showed that it had been running at impact. The aircraft and power pack were weighed and their individual centres of gravity determined, for use in future calculations (see paragraph 1.6.2).

1.13 Medical and pathological information

The autopsy findings indicated that the pilot struck firm ground head first and bounced on his chest. No evidence of any medical factor which might have caused or contributed to the accident was revealed either by the autopsy or from the pilot's medical records.

1.14 Fire

There was no fire.

1.15 Survival aspects

This is considered to be a non-survivable accident. The pilot wore an open face motorcycle helmet, the dome of which was found intact. However, it was noted that there was very little space between the webbing harness of the helmet and the thin layer of cork lining the dome. As the riveted attachment showed no evidence of tearing, this suggests that the webbing had stretched. Localised bruising of the scalp indicated that the pilot's head had contacted the cork lined dome at impact.

1.16 Test and research

1.16.1 Test rig and programme

Early in the investigation it became apparent that adequate numerical data on the stability, control and performance characteristics of hang gliders which was essential for this investigation was not available. Enquiries revealed that although some work had been carried out on hang glider models in wind tunnels, modelling of a specific type to a scale acceptable in existing tunnels was not practicable because of the extreme elasticity of this type of aircraft. As there was no facility for full scale wind tunnel testing it was decided, in co-operation with the CAA and the BHGA, to construct a mobile rig and to carry out tests to determine the relevant flight characteristics of the accident aircraft. The basic requirements of the test vehicle were that it should be capable of measuring and recording forces generated by the attached glider in simulated flight conditions. The relevant data to be measured were: lift, drag and side forces; pitch, roll and yaw moments together with pitch and yaw attitudes; airspeed and engine speed. Three design proposals were examined and one was selected on the basis of its greater potential accuracy, its adaptability for mounting different glider designs, and the scope and ease of operation of the on-board data acquisition and processing equipment.

The design chosen was a removable framework superstructure mounted on a Citroen CX2400 estate car with self-levelling suspension (See Appendix 5). A hang glider could be attached to the top of the superstructure at a height of eight metres above the ground. Load cells in the mountings provided a measuring capacity equivalent to that of a six-component wind tunnel balance. Extendable sections in the glider attachment struts controlled by electric servo motors enabled incidence and sideslip angles to be varied continuously. Aircraft engine power could also be controlled and monitored, and the rig was fitted with a wind speed and direction indicator. The rig was equipped with an on-board computer for control of the test operations, data from the sensors being then recorded on an audio magnetic tape cassette for later reduction and analysis in a microcomputer.

Two hang gliders were used in the tests – the repaired accident machine and a production Falcon IV. The parameters used in the investigation of their flying characteristics were pitching moment coefficient (C_M), lift coefficient (C_L), and angle of incidence (α). All pitching moments and their coefficients were resolved about the junction of the glider keel tube with the control frame, and should be distinguished from moments acting about the centre of gravity of the gliders when they are in normal flight.

The test programme was as follows:

Test	*Purpose*
A	To determine the variation of C_L and C_M with α of the production Wasp Falcon IVB hang glider (Appendix 6A)
B	To determine the variation of C_L and C_M with α of the modified Falcon IV as a pure hang glider (Appendix 6B)
C	To determine the variation of C_L and C_M with α of the modified Falcon IV when fitted with a Soarmaster power unit – engine not running (Appendix 6C)
D,E,F	As test C, but with engine running at ½, ¾ and full throttle respectively (Appendices 6D, E and F)
G	To determine changes of thrust with sudden throttle opening in 1g flight at 29 mph (13 metres/sec), modified Falcon IV with Soarmaster power unit

The test results were analysed by the Flight Mechanics Department of Cranfield Institute of Technology. Once the tests were completed the test rig was handed over to the British Hang Gliding Association so that it could be used for future research, development and certification of hang gliders.

It had to be borne in mind when drawing conclusions from the results obtained from the test rig that absolute values should be treated cautiously. This was necessary because use was being made of an untried device in a development state. However, it is considered that comparison of results obtained in different tests was justified on the grounds that all were subject to the same conditions.

1.16.2 *Test results*

Tests A and B allowed comparison of the lift and pitching moment characteristics of the production Falcon IV sail with that of the modified sail without motor. Appendices 6A and 6B show that those of the modified sail are remarkably similar to those of the production glider. Such variations as are present demonstrate a marginally greater pitch-up tendency in the higher ranges of incidence and speed, and slightly less pitch-down tendency in the lower ranges occurring before the point at which the nose of the sail reverse inflates. Having established this similarity, the remainder of the tests were carried out using the modified aircraft.

Test C investigated whether the addition of the inert engine mass altered the C_L/α or C_M/α characteristics. It is apparent from comparison of the graphs at Appendices 6B and 6C that these were virtually identical, and therefore that the position of the engine could have had little effect on the static stability of the machine.

Tests D, E and F were devoted to the characteristics of the modified aircraft at various power settings. Comparison of the C_L/α curves obtained in these tests (Appendices 6D, E and F) with those of the unpowered machine revealed a steeper C_L gradient, particularly at lower speeds. This represents the increased lift potential for a given pitch attitude provided by the effect of power, and was an expected flight characteristic. Examination of the C_M/α curves so derived show little difference between the powered aircraft and those of either the production or the modified unpowered gliders within their normal operating incidence range at constant power. However, at the lower incidences the slope of the C_M/α curves becomes markedly steeper at the higher speeds exhibiting increasingly unstable pitch characteristics with increasing power.

Test G was devoted to investigating the pitching moments whilst the engine was accelerated as rapidly as possible. For this purpose 1g cruising flight was set up at approximately 29 mph (13 metres/sec) with the engine at idle. The throttle was then rapidly opened and the engine allowed to accelerate to its maximum speed. The values of thrust, pitching moment and engine speed were then compared on a time basis. All three parameters are plotted at Appendix 6G. It can be seen that throughout the engine acceleration the pitching moment shows a slight nose-up increase due to the moment of the engine thrust line about an assumed centre of sail drag at the heart bolt, which is at the junction of the keel tube and the control box. In such a situation in powered flight the aircraft would pitch nose-down as the result of the moment of the thrust about its centre of gravity. Appendix 6H, derived from data acquired during test B, shows the variation of drag with incidence at a speed of 28 mph (12.5 metres/sec). It is apparent that drag decreases significantly with reducing incidence down to incidences of 15°.

2. Analysis

2.1 The evidence of the witnesses and from the film shows that the pilot was flying the low pass manoeuvre that he had planned when, at about 100 feet, he put his machine into a dive and simultaneously increased power by means of the mouth throttle. The aircraft pitched sharply nose-down, experiencing reduced loading with the pilot's body being thrown upwards relative to the wing. The machine continued to dive with the pilot's arms fully extended grasping the control bar, and it impacted the ground at an angle of about 40°. Weather was not a factor in the accident, and there was no failure or malfunction of the airframe or the engine.

2.2 The research programme comparing the production Falcon IV with the accident machine in glider form without engine established that the modifications to the rigging and sail area left the latter with very similar flight characteristics to that of the former. In particular the pitching moment/incidence curves of the production Falcon IV and of the modified machine indicate that both had near neutral longitudinal static stability in the normal working incidence range which changed to a negative value at very low incidence. This compares with the positive value that is a characteristic of conventional aircraft. However this level of stability is typical of third generation hang gliders, to which the pilot was accustomed and which were in widespread use. These facts lead to the conclusion that the modifications to the rigging and sail area were not a significant factor in the accident, although the Varitrim collar would have had to be set in a more nose-down position than in the production Falcon IV – as was found to be the case.

2.3 The addition of the mass of the Soarmaster power unit resulted in an increase in the machine's weight and a vertical shift of its centre of gravity. As far as ability to trim is concerned, as the centre of gravity of the Soarmaster unit was close to that of the airframe it would add little to the moment required to trim the aircraft and so the movement of the pilot's body needed to retrim at a changed incidence would have been little altered. As far as control is concerned, whilst the control moment which the pilot could apply by moving his body would remain unaltered, the extra mass of the engine would result in a higher glide speed at a given incidence. The moment coefficient which the pilot could apply would therefore be reduced inversely as the mass increase. Moreover the moment of inertia of the machine would be increased by about one quarter. The available acceleration in pitch would therefore be reduced by approximately one fifth which could make the machine less responsive, but not seriously so.

2.4 Considering the machine in powered flight, the C_M/α curves established for three thrust levels indicate changes in its longitudinal static stability from that of the unpowered version, and these changes are more marked as power increases. At the higher incidences there is a progressive increase in stability, and the primarily neutral stability over the normal operating range becomes increasingly unstable as incidence is reduced. In sum the effect of power is stabilising at the higher incidences and de-stabilising at the lower.

During the accident flight the pilot was seen flying level for a few seconds under constant power and with his hands off the control bar. This suggests that the Varitrim had been set so that the lift-weight and thrust-drag couples were in balance in this flight condition.

2.6 The evidence shows that the pilot initiated the dive when flying past the hang gliding site at a height of about 100 feet by pulling firmly on the control bar, and that at about the same time he increased power significantly by means of the mouth operated throttle. By these means engine thrust was increased, and the change of incidence reduced both lift and sail drag. There would thus have been a significant increase in nett thrust, which would have resulted in a considerable nose-down pitching moment due to the distance of the line of action of engine thrust, and of sail drag, from the machine's centre of gravity. Assuming a drag of 30 lbs (13.6 kg) just before the pilot initiated his dive, if he opened the throttle fully as he reduced incidence (and so drag) there could have been an excess of about 60 lbs of thrust over drag, made up of some 50 lbs (22.7 kg) of propeller thrust and 10 lbs (4.5 kg) of reduced sail drag. With an arm of 26 ins (66 cm) about the centre of gravity this would result in a moment of 1560 lbs ins (176 Nm). To counter this the pilot would need to move his body aft by some eleven inches (28 cm) in 1 'g' flight which is more than half the total available movement and so could have exceeded the movement available to the pilot from his original trimmed position. The situation would have been worse at less than 1 'g'.

2.7 Further, the decrease in incidence and increase in thrust would have had an adverse effect on the machine's longitudinal static stability, probably taking it from a region of neutral stability to a region of negative stability. The cumulative effect of these factors appears to have been the cause of the sudden and violent nose-down pitch which occurred immediately after the dive was initiated by the pilot. It is apparent from the film that during this pitch-down there was an appreciable reduction in normal acceleration ('g'), the pilot's body being flung towards the sail with his fully stretched arms grasping the control bar. This was the limit of nose-up control that was possible but its effect would have been considerably reduced by the decrease in loading to below 1 'g', and it was demonstrably insufficient to reverse the pitch-down.

2.8 The evidence indicates that the machine stabilised at a steady dive angle of about 40° momentarily before striking the ground. This suggests the possibility that, if more height had been available, the eventually increasing drag and a return to 1 'g' flight might have resulted in full nose-up control application being then sufficient to generate a nose-up moment for recovery. However, this must remain speculative as not enough is known about the aeroelastic effects on the structural members, and on the sail tension and shape. More importantly, with greater height the pilot would have had time to switch off the engine, or even to reduce power by means either of the mouth or the hand throttle, and it is likely that this would have enabled a recovery to be made. Unfortunately the dive manoeuvre was entered from too low to allow a sufficient margin for recovery from the unexpected and severe handling problem that the pilot encountered.

3. Conclusions

(a) *Findings*

(i) The alterations to the sail and rigging made to the standard Wasp Falcon IV hang glider made little or no difference to the machine's flying qualities.

(ii) The addition of the Soarmaster power unit reduced the machine's control response somewhat and provided the potential for considerable pitching moment changes with large alterations of power.

(iii) When in powered flight at the lower range of incidences the machine's inherently neutral static longitudinal stability tended to become negative.

(iv) Atmospheric conditions were not a factor in the accident.

(v) The pilot had little experience in powered hang gliders.

(vi) The pilot initiated a dive from a height of about 100 feet with a firm control application and increased power significantly at the same time.

(vii) The violent nose-down pitch which occurred almost immediately was due primarily to the effect of a large increase in nett thrust that resulted from the increase in power but also from the reduction in sail drag due to the reduced incidence, superimposed on the machine's divergent pitching characteristics with power and airspeed at low incidence.

(viii) The machine was then out of control and it dived into the ground at an angle of about 40°, the pilot being killed.

(b) *Cause*

The accident occurred because the pilot encountered an unexpected and violent nose-down pitch caused by a large rise in nett thrust when he increased power as he put the aircraft into a dive, there then being insufficient height for recovery. A contributory factor was the pilot's lack of experience on powered hang gliders.

4. Safety Recommendations

None.

D A Cooper
Inspector of Accidents
Accidents Investigation Branch
Department of Trade
March 1983

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