

AIRCRAFT ACCIDENT INVESTIGATION SUMMARY REPORT

COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF CIVIL AVIATION
Transport

Reference
AS/743/1028

1. LOCATION OF ACCIDENT

Tooradin Aerodrome, Victoria	Height a.m.s.l. (ft) 20	Date 5 May 1974	Time (Local) 1650	Zone BST
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2. THE AIRCRAFT

Make and Model Mata Sokol L40	Registration VH-DUX	Certificate of Airworthiness	Valid from 12.2.71	Valid to 11.2.80
Registered Owner (name and address) L.M. Lillie 53 Heyington Place Toorak, Vic. 3142	Operator (name and address) J.L. Ellis 5 Heales Street Dromana, Vic. 3936	Degree of damage to aircraft Destroyed		
		Other property damaged Nil		

Defects discovered

Irregular operation of the automatic cut-out in the electrical pitch change mechanism due to corroded contacts, causing the pitch change mechanism to sometimes stop short of the required full fine pitch setting.

3. THE FLIGHT

Last or intended departure point Tooradin	Time of departure 1650	Next point of intended landing Moorooduc	Purpose of flight Travel	Class of operation Private
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4. THE CREW

Name	Status	Age	Class of licence	Hours on type	Total hours	Degree of injury
Jacques Louis William ELLIS	Pilot	53	Senior Com	25	20,000 plus	Minor

5. OTHER PERSONS (all passengers and persons injured on ground)

Name	Status	Degree of injury	Name	Status	Degree of injury
Michael PARUSEL	Passenger	Nil	Maureen PELSTAD	Passenger	Minor
Ross WELCHMAN	"	"			

6. CONTRAVENTIONS OF REGULATIONS AND ORDERS

Regulation or Order No.	Nature of contravention

7. RELEVANT EVENTS

After spending some time at the Tooradin air pageant the pilot decided to return to Moorooduc. He taxied in a stream of departing aircraft to one access position 544 feet from the threshold of the 2770 feet 06/24 natural surface strip. He completed an engine run-up and cockpit checks, including engaging the supercharger, and selected the flaps to the take-off position. When cleared to enter the runway the pilot lined up adjacent to the taxiway and commenced take-off. There was no significant wind. After travelling about 1400 feet the aircraft bounced into the air at a ridge on the surface, then settled back onto the ground before bouncing into the air once more. Hearing the end of the runway the pilot realized that the aircraft performance was below normal, so lifted the aircraft off to clear short mangrove scrub and a creek. About 500 feet beyond the runway the right wing struck a tree and the aircraft slid and rolled to a halt in an almost inverted attitude. The occupants exited the aircraft through a hole broken in the canopy by the pilot. Subsequent investigation revealed that when the aircraft came to rest the propeller blades were at a position approximately halfway between the fine and coarse pitch settings. The engine performed normally when ground tested and the only irregularity found was the defect in the propeller pitch change mechanism.

8. OPINION AS TO CAUSE

The probable cause of the accident was that take-off was attempted with the propeller blades in other than the full fine pitch, due to an irregular operation of the pitch change mechanism. The pilot's low experience on the type may have been a contributory factor.

NARRATIVE (give a concise chronological account of the sequence of events)

Earlier on the day of the accident the aircraft VH-DUX had been flown by the owner, with two passengers on board, from Moorooduc to Tooradin. For take off from Moorooduc the supercharger had been used. The aircraft landed on the 06 strip at Tooradin. Later the owner took off from the same strip again utilising the supercharger, and returned to Moorooduc. The aircraft performed normally throughout this flight and no irregularities were noted.

At Moorooduc, Mr Ellis was offered the aircraft by the owner to attend the air pageant at Tooradin. With three passengers he arrived at about 1530 hours and about an hour later decided to return to Moorooduc.

The same three passengers boarded the aircraft and it was taxied in a stream of departing aircraft to an access point along the taxiway which joined the 06 strip some 500 feet from the threshold. Near this junction of the strip and taxiway an ATC officer, who was in radio contact with a temporary control tower, was positioned to give visual take-off clearance to non radio-equipped aircraft. The pilot, while holding in this area, completed pre-take off checks which included checking operation of the propeller pitch change mechanism. Full fine pitch was set for take-off.

From this taxiway/strip access point to the northern end of the 06 strip, there was 2270 feet available for take off. An overrun of 130 feet was also available before it was terminated by a mangrove lined creek crossing at right angles to the strip. The wind conditions at the time are said by the pilot to have been about 5 knots, from the west-north north, (giving a slight downwind component) and by several witnesses on the ground as nil at the time VH-DUX took off.

The pilot was cleared for take off. He taxied forward on to the strip, lined up, applied full throttle and released the brakes just before full power was reached. As full power was applied, the pilot selected the supercharger ON and noted engagement by the achievement of the required minimum engine r.p.m. and a distinctive noise. The take-off was commenced at the same point as the preceding aircraft and several aircraft before that, although a twin engined aircraft had earlier requested and utilised the full runway length.

The acceleration during take off seemed reasonable to the pilot although he claimed he felt occasional retardations from patches of the surface. On reaching the intersection of the 11/29 strip, after a take-off run of about 1400 feet, the aircraft had attained 40-45 knots. It bounced into the air at a ridge on the intersection and sank back onto the ground. The evidence indicated that the aircraft bounced once more. The pilot became concerned and looked for the end of the strip which he said was not clearly visible. When suddenly he saw the strip end he applied back pressure to the control column and lifted the aircraft to clear the mangroves and the creek. The aircraft rose about 10 feet into the air, but failed to climb away.

The aircraft cleared the creek but then the starboard wing struck a small tree. The pilot maintained direction with rudder before closing the throttle and keeping the aircraft in a nose up attitude to stall it onto the ground. The aircraft tipped up and then rolled to the left before coming to rest nearly inverted.

The pilot turned off the fuel and switches, before breaking the perspex canopy and exiting. He then assisted his passengers to leave the aircraft. With the passengers clear of the aircraft the pilot returned and turned off the battery and generator switches.

JUSTIFICATION (state concisely the reasons underlying the opinions described in Section 8 of this report, and indicate why this opinion is preferred to the possible alternatives.)

The take-off weight of the aircraft, the position of the centre of gravity, and the pilot's qualifications to fly the aircraft type do not require consideration in this analysis. Several points can be made at the early stages of the analysis to act as a basis against which other matters can be discussed. The preliminary points to be dealt with concern the weather at the time of the accident, and the length and surface condition of the strip. With this background established, a detailed study can be made of the operation and serviceability of the aircraft.

2. The pilot has stated the wind was from the west-north-west at five knots, while ground witness evidence indicates there was nil wind. If the evidence of the pilot is correct, the wind was on the port rear quarter at the time of take off, and would have given the aircraft a downwind component of about three knots. It is therefore concluded that the wind velocity was not a significant factor in the cause of the accident.

3. Concerning the airstrip, the pilot, and indeed any pilot, would have been wise to utilise the whole length of the strip. Certainly the surface on the south end of the taxiway has been unfavourably commented upon, but aircraft landed on the strip throughout the day, and one twin engined aircraft at least used the full strip. Whether Mr Ellis was aware of the length of strip behind him as he lined up, or of the length ahead of him, matters little when it is certain that he did have the necessary factored take off distance of 1850 feet ahead of him which should have permitted his aircraft to become safely airborne and be at a height of 50 feet at the far end of the strip. For further argument, if a three knot downwind is accepted, a safe flight situation should still have existed over the northern end of the strip, based on the performance chart. It will be noted that the owner of a similar aircraft, VH-DUY, found during tests at Warrnambool that his aircraft reached 50 feet at about 2000 feet along a runway, at maximum all-up weight of 2094 lbs.

4. As for the surface of the strip, this was assessed by the investigator as suitable for the take off, and any minor drag which it might have caused is not considered to be of significance in the accident.

5. It must be considered purely coincidental that the aircraft came to rest 480 feet beyond the end of the strip, a distance about equal to that which the pilot had behind him as he lined up for take off. There is no evidence to indicate that the pilot might have abandoned the take off earlier and came to a safe stop on the strip, or got airborne, albeit unsteadily, had he used the full length of the strip. It can also be argued that there was an equal chance the aircraft might have nosed into the creek with more serious consequences to the occupants. Therefore, it is assessed that the strip length used met the performance requirements of the aircraft.

6. The pilot has provided a number of figures which he states were obtained during the pre-take-off engine run-up check. Specific figures quoted under these circumstances are unreliable, but since the tests were carried out and the pilot proceeded with the take-off, it is evident that he did not consciously note anything abnormal. Nevertheless, an experienced ATC officer was of the opinion, based on engine noise, that the aircraft was not developing full power on the take-off run, and other witnesses expressed the view that it was not fast enough to remain airborne. The consensus of opinion indicates that the engine did not deliver full power during the take-off run, hence the cause of the accident lies in the reason for this loss of performance.

7. The pilot states that the fuel and ignition checks prior to take-off were normal, and the engine was found to operate satisfactorily when tested at Moorabbin after the accident. Nevertheless, there are two pilot controllable areas which could have produced the apparent loss of engine performance. These are engagement of the supercharger

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and whether or not the propeller was set at full fine pitch.

8. Looking firstly at supercharger engagement, the knob was found to be in the fully forward - disengaged or OUT position, when the wreckage was examined. Mr Ellis states that he engaged the supercharger by pulling the knob out whilst opening the throttle fully, and noted that the RPM was "above 2350 in fact it was 2400 RPM". He also stated that the engine would achieve only 2350 RPM if the supercharger was not engaged, and that he noted the characteristic "scratchy" sound which is associated with engagement. It will be noted, however, that in the tests carried out on this engine, at Moorabbin, with pitch full fine the engine achieved 2450 RPM with supercharger OUT and that Mr McCosh, the owner of VH-DUY, has found that the engine in VH-DUY achieves 2400 RPM with supercharger OUT and the aircraft static. It will also be noted that the owner of VH-DUX, Mr Lillie, did not rely on static checks to ensure that the supercharger was engaged, but checked RPM build up during the take-off run.

9. It is evident from the above that the engine ground run checks carried out by Mr Ellis were inadequate to positively establish that the supercharger was engaged. Witness evidence does however support that Mr Ellis engaged the supercharger, since two witnesses state that he called the supercharger check aloud, and one witness states he saw 2700 RPM during take-off. This latter evidence is itself open to question, since the witness recalled the pilot mentioning this figure prior to departure from Moorooduc. The fact that the supercharger control knob was found to be in the OUT position after the accident is not in itself compelling evidence, since Ellis mentioned turning some switches off after the accident but did not mention others that were found to have been turned OFF, or alternatively the knob could have been accidentally pushed in when the occupants were getting out of the wreckage. Finally, since the supercharger gives a 25% increase in horse power in the early stages of the take-off run, it is felt that such a loss of power would have been self evident. For these reasons Mr Ellis' evidence that the supercharger was engaged is accepted.

10. Looking now at the propeller pitch aspects, the tests carried out after the accident, at Moorabbin, established that the electric pitch change mechanism is normally capable of moving the blades through 11°. The specialist report shows that an intermittent fault existed in the pitch change mechanism and that the blades were at a measured 12.2° when it was expected that they would be at a fully fine setting of 7°. The pitch change mechanism was not damaged in the accident and the nature of the electrical actuator mechanism is such that the blade position was unlikely to have shifted mechanically either during the accident or salvage.

11. The propeller control switch was found OFF at the accident site. Normally this switch could be expected to be ON for take-off but once full fine was set for take-off it could be put OFF until a pitch change was required during climb or cruise. This switch too could well have been put OFF, or knocked OFF, after the accident.

12. The engine run-up checks made by the pilot included a check of the pitch change mechanism, by opening the throttle to 1600 RPM and activating the system to coarse pitch. The pilot states that the RPM reduced to the required 1100, and returned to 1600 when the INCREASE button was pressed. If these figures could be accepted as having been accurately observed at that particular run-up, they would establish that the propeller mechanism had moved through its full range and returned to full fine. Again the figures are believed to be unreliable, as few pilots take the time to allow RPM to settle at the lower range, and actually note the coarse pitch RPM, during routine pre-flight engine checks.

13. If the propeller pitch was not at full fine at that time (due to the intermittent fault found during the subsequent tests), 1600 RPM would still be achieved

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because the pilot was not relating throttle movement to manifold pressure. If he then followed the usual procedure of simply pressing the DECREASE button until a significant RPM drop was produced and then activated INCREASE back to 1600 RPM, the test carried out at that time would prove nothing other than that the pitch change system was operating.

14. Following the 1600 RPM check, the next stage at which some indication of the propeller pitch could have been obtained was with the introduction of the supercharger. He states that the RPM at full throttle was "above 2350 RPM in fact it was 2400". When tested at Moorabbin after the accident, the engine achieved only 2100 RPM at full throttle with the pitch in the "as found 12.2°" setting, but 2525 RPM in full fine. It appears therefore that if Mr Ellis' quoted figure of 2400 is correct, the propeller pitch was at an angle less than 12.2° at that time, but still was not in full fine.

15. Consideration must be given to the possibility that the pilot inadvertently actuated the DECREASE button at some late stage in the engine run-up procedure, or during the take-off run. Only momentary contact would move the propeller off the fine pitch stops, as the total range is covered in less than five seconds. There is also the possibility that the DECREASE button could have been actuated during or after the accident. There is no evidence upon which these possibilities can be resolved.

16. The strongest positive evidence to emerge from the investigation is that there was a mechanical defect in the pitch change mechanism and that the propeller blades were not at the fine pitch setting when the aircraft came to rest. It is reasonable to conclude that the pitch was at this setting during the take-off and was the cause of the loss of take-off performance which led to the accident. This view is supported by information obtained from Mr McCosh, owner of VII-DUY, who some years ago experienced a similar loss of performance due to having the pitch incorrectly set, but detected it late in the take-off run. He used some 3000 feet of runway before realizing that he had coarse pitch selected.

17. It is relevant to the cause of the accident to explore whether Mr Ellis could have been expected to detect such a degradation in performance sufficiently early to permit him to safely abandon the take-off.

18. From the various points made in this analysis it is evident that Mr Ellis was not fully informed on some details relative to operation of this particular engine/propeller combination, and that the checks he carried out were less comprehensive than those used by other pilots who were consulted during the investigation. It is surprising that he seems to have made no reference to the manifold pressure during the pre-take-off checks, nor does he mention any power checks during the take-off run. Mr Ellis is a very experienced pilot, but had only 25 hours total experience on this type over the past 18 months, and only three hours in the past 90 days. Whilst it appears that his proficiency on the type was such that he overlooked some checks that might have detected the sub-normal performance, particularly during the take-off run, it can not be confidently stated that the loss of performance would have been clearly evident sufficiently early in the sequence of events. The aircraft performance is marginal even at its best, and the degradation caused by the pitch control defect may not have been evident at the early stages. Ellis apparently noticed some "drag" on take-off, but attributed this to the strip surface. It is concluded that whilst Ellis may have detected the discrepancy in time to avoid the accident if he had had more experience on, or more detailed knowledge of, the aircraft type, it would be unreasonable to attribute the accident to pilot error. Based on the above, the probable cause of the accident was that due to an intermittent defect in the pitch change mechanism, the pilot attempted to take-off with the propeller pitch in other than full fine.

20. ACCIDENT PREVENTION

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(Describe the lessons to be learned from this accident.)

This accident highlights the need for pilots to be in current practice, and to have full knowledge of their aircraft. Had this pilot been more familiar with the details of the engine/propeller combination there was a chance, although not rated as "high", of his detecting the abnormal manifold pressure - r.p.m. combination which probably existed. Similarly a careful watch on the take off r.p.m. may have disclosed the pitch anomaly at a position enabling a safe course of action to be taken, both at Moorooduc and Tooradin.

Although the above pilot unfamiliarity has been mentioned, the accident was basically the result of a mechanical failure, which the pilot, at the time of external inspection of the aircraft, could not be reasonably expected to detect.

21. ATTACHMENT CHECK LIST

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|---|---|---|
| <input checked="" type="checkbox"/> Witness statement (No. 6) | <input type="checkbox"/> Flight plan | <input checked="" type="checkbox"/> CA Form 461 |
| <input checked="" type="checkbox"/> Investigator's notes (No. 11) | <input type="checkbox"/> Meteorological report | <input type="checkbox"/> CA Form 462 |
| <input type="checkbox"/> Transcript of communications | <input checked="" type="checkbox"/> CA Form 225 | <input type="checkbox"/> Autopsy report |

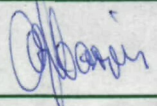
Specialist report (describe) **Airworthiness: Investigation into engine and propeller performance, Meta Sokol L40, VH-DUX involved on Take-off at Tooradin 5 May 1974**

Other (describe) **Performance Chart PL 55.3-L40/1
Certificate of Airworthiness
Air Display Briefing Sheet**

22. PARTICIPATION IN THE INVESTIGATION

Name	Affiliation	Wreckage security provided by
S. Spinks P. Knowles	Inspector Air Safety Airworthiness Engineer	Police
		Name of first investigator to reach site A.G. Harris
		Date/time of arrival (local) 6.5.74 0900 hrs

23. INVESTIGATION RESPONSIBILITY

Name of officer responsible	Signature	Designation	Date
A.G. Harris		ASIH	1/10/75