WHEELS-UP LANDING IN HS-125

While making what was intended to be a "touch and go" flapless landing at Avalon, Victoria, a Department of Civil Aviation HS-125 landed with the undercarriage retracted. The aircraft caught fire, and was substantially damaged, but the two pilots escaped without injury.

The aircraft was on a training exercise and had been carrying out a series of circuits and "touch and go" landings during which normal and emergency procedures were being practised. Both pilots had the status of check captains on the HS-125 and the pilot in the left-hand seat flew the aircraft while the other pilot performed the functions of co-pilot and check pilot. After a training sequence covering six "touch and go" landings the pilots exchanged seats, and their respective roles. The training sequence was then being repeated.

As the HS-125 was approaching for its eleventh landing, an R.A.A.F. Mirage was taxi-ing for take-off and, to allow the Mirage to turn left after taking off, the tower instructed the HS-125 to make a right turn after the "touch and go" landing and report west of the airport. The HS-125 made the "touch and go" and turned right as instructed and it was then decided that the next landing would be made in the unflapped configuration. The two pilots discussed the target threshold speed required for the approach and commenced the pre-landing checks.

By this time the Mirage had lined up for take-off. The tower instructed the HS-125 to report approaching a right base and advised that it might be necessary for them to fly one holding pattern to the north-west of the field. The HS-125 acknowledged this transmission as the Mirage commenced its take-off run. The HS-125 was then instructed to continue on to a right base and to report on final.

After the HS-125 had turned on to base leg, the pilot in the right hand seat noticed that the flag warnings for the localiser and the glide slope indications were showing on the instruments, indicating that the runway ILS was inoperative. He called the tower to query this, and was informed that the ILS had been switched off so that crash barriers at the end of the runway could be erected while the Mirage took off.

The HS-125 continued the approach, and, at about 200 feet on late final, the pilot flying the aircraft closed the throttles fully to reduce the airspeed to the target threshold speed of 115 knots. With the undercarriage still retracted, the aircraft crossed the threshold at 30 to 40 feet and touched down smoothly on the fuselage keel skid. It was only as the aircraft was skidding along the runway, that the crew realised that the undercarriage was not extended, and they immediately closed the high pressure and low pressure fuel cocks. As the aircraft came to rest, the tower advised the crew that the rear section of the aircraft was on fire. The crew turned off the master battery switch, and evacuated the aircraft through the main cabin door. Units of the airport fire service quickly reached the aircraft and extinguished the fire with foam.

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When the aircraft was inspected, all three undercarriage legs were found in their fully retracted positions and the nose wheel doors were closed. The flaps were also fully retracted. Marks on the runway showed that the aircraft had slid for 2,400 feet before coming to rest. The fuselage keel skid had worn away completely, during the ground slide, exposing the fuselage skin to the friction of the runway. The runway friction had ruptured the centre section integral fuel tank, allowing fuel to escape, and had provided a source of ignition. When the aircraft came to rest, fuel continued to leak from the damaged tank, feeding the already established fire.

Inspection of the cockpit showed that, although all components of the undercarriage were in the retracted position, the undercarriage selector lever was in the "down" position. The flap lever was in the "up" position and both high and low pressure fuel cocks were off.

After the initial inspection had been completed, the aircraft was lifted and removed from the run-

way on trolleys. It was then raised on jacks and subjected to further examination to test the operation of the undercarriage mechanism and its associated warning systems. Particular care was taken, while the aircraft was being raised, not to interfere with the hydraulic or electrical systems.

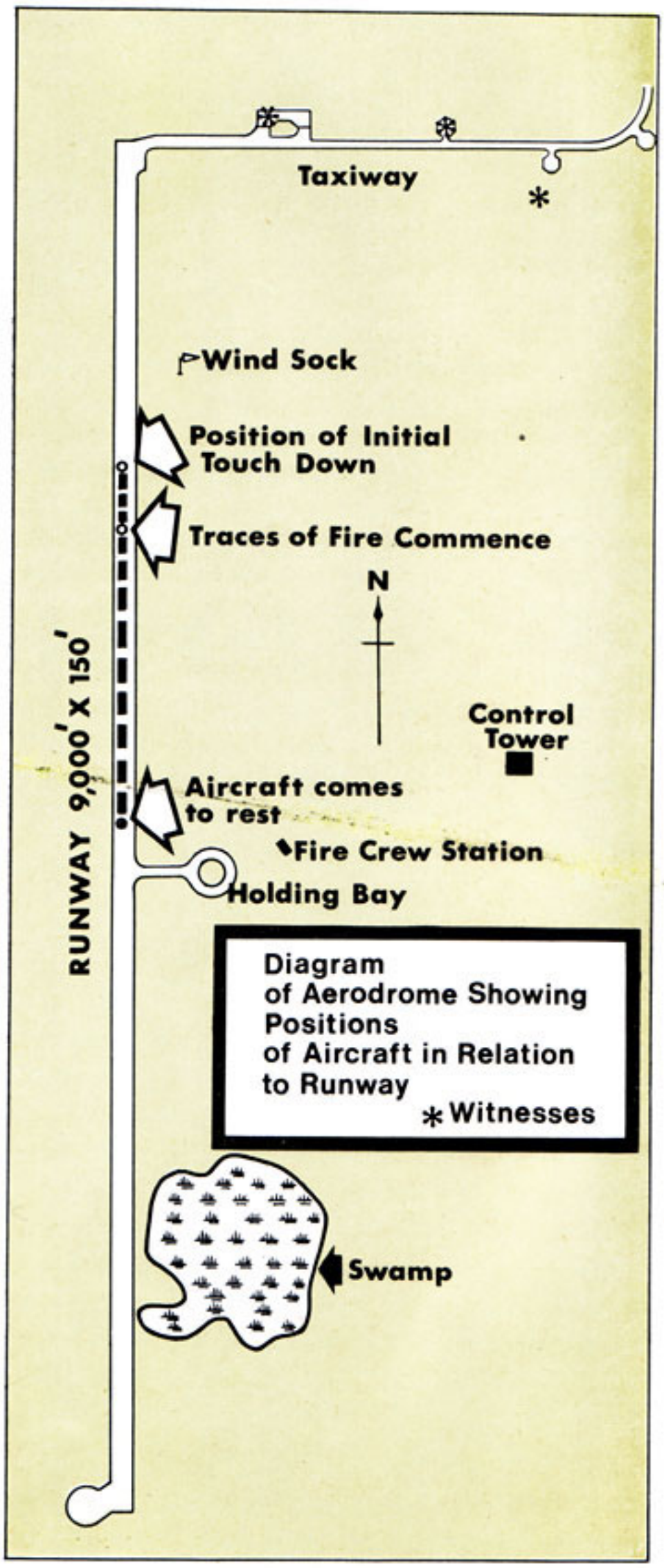
The undercarriage of the HS-125 is operated hydraulically. The electrically operated warning system comprises three red lamps which illuminate when the undercarriage is in transit, either up or down, three green lamps which illuminate when the undercarriage is down and locked, and a warning horn. The warning horn sounds when the undercarriage is not locked down and either throttle lever is retarded below about the 60 per cent thrust position, or if approach or landing flap is selected while the undercarriage is not locked down. There are also mechanically operated position indicators for each of the three undercarriage legs. The mechanical indicator for the nose leg is mounted on the central control pedestal in the cockpit and the main leg indicators are located on the upper surface of each wing immediately above their respective undercarriage legs. The mechanical indicators for the main legs are not visible from the cockpit.

The electrically operated undercarriage warning system makes provision for the warning horn to be silenced, if required, when it is actuated by retarding either one of the throttle levers. The warning horn circuit is automatically re-armed immediately either throttle lever is re-advanced beyond the warning horn activating position. There is no provision for silencing the warning horn when it is activated by extending the flaps.

Inspection of the aircraft's hydraulic and electrical systems showed that, although components and wiring in the rear equipment bay had been subjected to excessive heat, the systems remained capable of operation for testing purposes, and there was no external evidence of any failure having occurred before the aircraft landed. Power was applied to the electrical system and, with the undercarriage selector lever still in the down position, the main hydraulic system was pressurized by operating the hydraulic hand pump located in the rear equipment bay. As pressure built up in the system, each undercarriage leg extended and moved into the locked down position. At the same time, the electrical and mechanical warning devices all operated normally. The undercarriage was then retracted and extended again by the same means, and again the warning devices operated normally.

The aircraft was then lowered on to its wheels, and towed to a hangar for further examination.

Diagram of Avalon Aerodrome.



Here it was again jacked up, and an external source of hydraulic pressure was connected to the aircraft's system through leads to the engine driven hydraulic pumps. A further number of undercarriage retractions and extensions were then carried out and on every occasion, the hydraulic system, the position indicating lights, and the warning horn all operated normally. The engine driven hydraulic pumps were removed from the aircraft and bench tested and both pumps were found to be capable of normal operation. Finally, the system was examined as far as practicable for evidence of contamination of fluid or other possible source of intermittent failure, but no such evidence was found.

Throughout the whole programme of testing, nothing came to light to indicate that the aircraft's undercarriage had been other than completely serviceable, or that the undercarriage actuating system and its associated warning systems had malfunctioned in any way.

The Air Traffic Controller on duty at the time of the accident said that although he had seen the HS-125 turning on to final about the time he cleared it for a "touch and go", he did not see it actually landing. He had been occupied in co-ordinating the Mirage's departure with the R.A.A.F., and when he next saw the HS-125, it had almost come to rest on the runway and was on fire. The aircraft's final approach and touch-down was seen, however, by a number of other reliable witnesses on the aerodrome, all of whom were positive that the undercarriage remained retracted throughout the final approach.

Both pilots said after the accident that they were certain they had not moved the undercarriage selector after the aircraft made contact with the runway. Neither pilot could positively recall moving the undercarriage selector to the down position, seeing the red "undercarriage in transit" lights or checking the green "down" lights and the mechanical nose leg indicator, but each believed they had followed the normal pre-landing procedures during the circuit, subject to the interruptions caused by the tower's instruction to vary their circuit pattern to allow the Mirage to depart, and the apparent failure of the runway ILS. Both pilots said that the undercarriage warning horn had not sounded when the throttles were retarded fully on final approach. However, the pilot who was flying the aircraft recalled that, early on the downwind leg, he had reduced engine power to the point where the warning horn had sounded and he had muted the horn at that time. It was evident that, throughout the remainder of the circuit, the throttles were not opened again far enough to re-arm the warning horn circuit. This, together with the fact that the flaps were not lowered, was undoubtedly why the warning horn did not sound during the final stages of the approach to land.

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It is quite clear from the investigation that the crew failed to make use of the means available to them to ensure that the undercarriage was extended and safe for landing. It is this question of why the crew omitted to follow the prescribed pre-landing checks that is of primary significance for there is no doubt that the cockpit indicators, had they been checked by the crew at the proper time, would have shown that the undercarriage was still retracted.

As a result of the accident, disciplinary action has been taken against the pilots concerned. The training sequences to be followed in Departmental aircraft have also been reviewed, together with the manner in which responsibilities are to be divided, when similarly qualified pilots are flying together in an aircraft for the purpose of maintaining proficiency.

The fact that an accident of this type can occur to an aircraft being crewed by two senior, highly experienced, professional pilots, is some indication of the degree of care necessary for the conduct of concentrated training exercises in modern complex aircraft. As cockpit sequences are repeated, circuit after circuit, it is unfortunately all too easy to gloss over, and perhaps to gradually disregard, the methodical implementation of the prescribed cockpit checking procedures so essential to safe operation. There can be little doubt that the insidious nature of the type of hazard inherent in such concentrated training exercises, is the most significant lesson to be derived from the HS-125 accident.