

**No: 1/89**

**Ref: EW/C1072**

**Category: 1c**

**Aircraft Type  
and Registration:**

Cessna F150K, G-AYEY

**No & Type of Engines:**

1 Continental Motors Corp O-200-A piston engine

**Year of Manufacture:**

1969

**Date and Time (UTC):**

24 June 1988 at 1859 hrs

**Location:**

Exbury, Hants

**Type of Flight:**

Training

**Persons on Board:**

Crew - 2

Passengers - None

**Injuries:**

Crew - None

Passengers - N/A

**Nature of Damage:**

General damage to wings, fuselage, landing gear and engine mounting.  
Heat damage to certain instruments.

**Commander's Licence:**

FAA Airline Transport Pilots Licence; UK Private Pilots Licence with  
Assistant Instructors Rating

**Commander's Age:**

28 years

**Commander's Total  
Flying Experience:**

Approx 2,500 hrs

**Information Source:**

AAIB Field Investigation

The aircraft was flown to its maintenance organisation on 20 June 1988 in order to have its time-expired engine replaced by a similar, half-life unit, which had been removed from a storm damaged aircraft. On completion of the engine change it was intended that the aircraft would be ferried back to its operating base at Goodwood by an assistant instructor, accompanied by a student pilot who wished to gain dual training experience in cross country flying.

The maintenance company stated that ground running of the engine, after installation, revealed that the alternator (which had been transferred with the engine from the damaged aircraft) was not producing any charge. Investigation suggested to them that the defect was not in the alternator itself, so they decided to replace the voltage regulator. Accordingly, a replacement component was removed from their stores and installed in the aircraft. Further ground running of the engine then indicated that the alternator was charging, albeit at a higher than normal rate. This high charge rate was attributed by the maintenance company personnel to a partly discharged battery resulting from a number of engine starts and sustained running with the alternator not functioning. The maintenance engineer then informed the waiting pilot and student that the aircraft was ready. He mentioned the high charge rate and that he would expect it to decrease as the battery became more fully charged. He also asked them to ensure

that the electrolyte level was checked after arrival at Goodwood, in case excessive evaporation took place as the battery re-charged during the flight.

Both pilots report that during the pre take-off engine run-up checks they expressed some disquiet that the charge rate showed little sign of decreasing.

Once established en-route at 1500 ft the instructor made radio contact with Southampton who asked him to call again as he passed Portsmouth. Shortly after that, the radio ceased to function and although the instructor changed the radio fuse, the unit again stopped operating almost immediately. At about this time the pilots became aware that the ammeter was indicating full deflection, ie 60 amps charge and also the fin mounted beacon was no longer functioning. They accordingly switched off the battery/alternator switch and continued their flight. As their destination airfield had ceased radio watch sometime earlier, the loss of all electrical services presented no major impairment to the continuation of the flight.

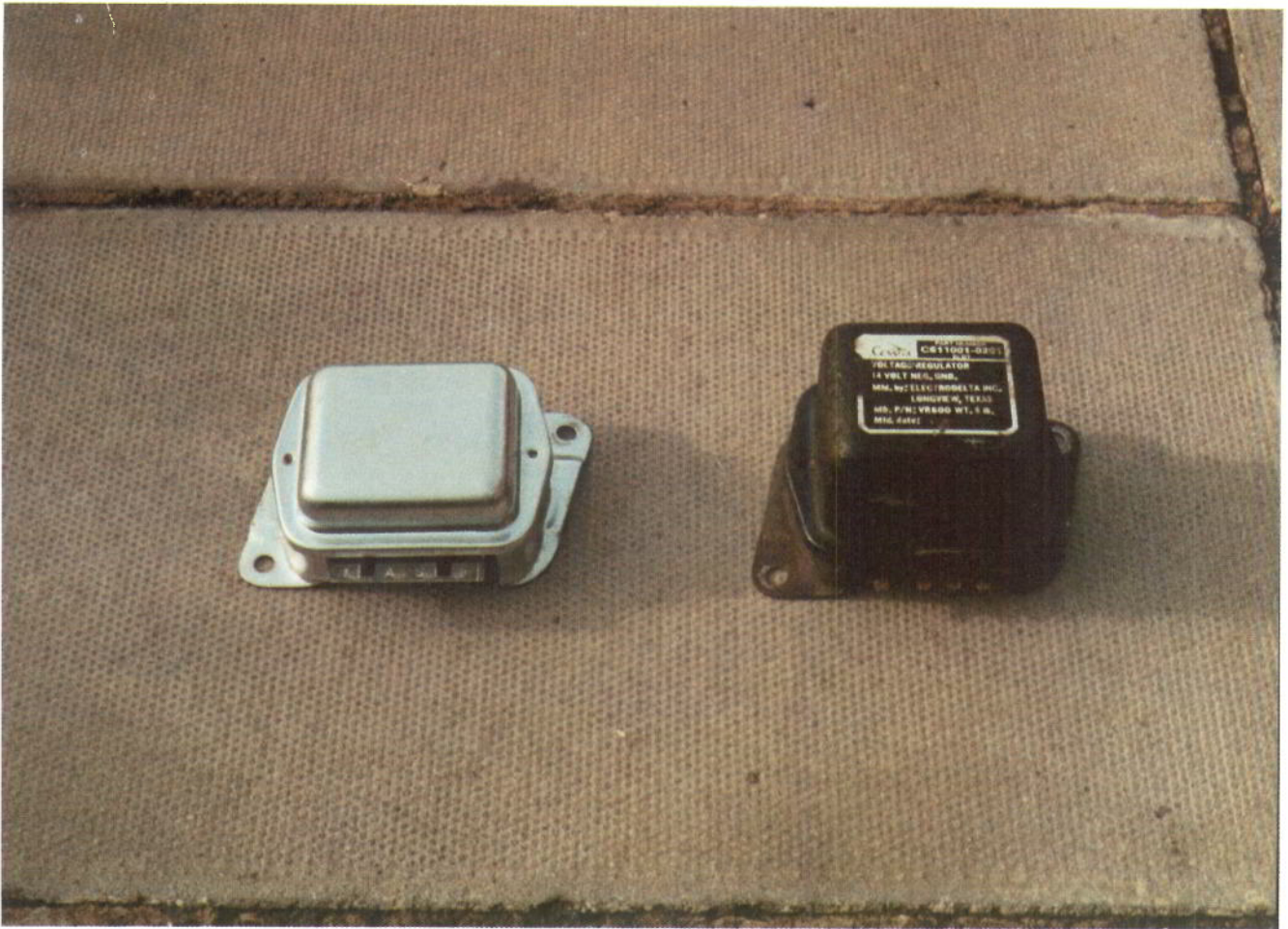
Approximately four minutes after the alternator was switched off the pilots became aware of a strong smell of burning accompanied by smoke in the cockpit. In view of the fact that all electrical power was already switched off, the instructor decided that the safest course of action was to switch off the fuel and carry out a forced landing. Unfortunately, the field finally chosen appeared from the air to be a normal pasture of grass, when in actual fact it contained a crop approximately five feet tall. After a short run through this crop, the aircraft nosed over and came to rest inverted. The occupants evacuated with little or no injury.

Examination of the aircraft revealed that the plastic casings of the fuel gauges had begun to melt and decompose as a result of heat conducted from the metal components within. The coils of the gauges had clearly reached a very high temperature and were virtually destroyed. The turn Co-ordinator, which was wired in parallel with the gauges via the same fuse, had ceased to function as a result of severe overheating of part of its internal electronics. Nonetheless the fuse on these circuits had not blown. The fuse supplying the radio, however, was found to have blown, as had the one fuse supplying both the fin mounted beacon and pitot-heater. With the exception of part of the beacon circuit, no defects were found in any of the circuits or components protected by those fuses which had blown.

Rig testing was carried out on the alternator and voltage regulator. The alternator was found to perform correctly but when the voltage regulator was placed in circuit with it no charge was produced. Internal examination of the regulator revealed that it had suffered severe heating damage to part of a circuit board. It was also noted that the regulator, although interchangeable with that originally fitted (ie having similar mountings and connectors) was different in design. In particular, the original unit incorporated an electro-mechanical relay, whereas the unit installed in the aircraft was a wholly solid-state device. Examination of the exterior of the unit revealed no identification of any sort, although examination of the circuit boards of both units suggested that they were intended to perform similar functions. The considerable difference in their designs, however, appears to have accounted for their different behaviour under failure conditions. The maintenance company which installed the regulator was unable to establish how the component had entered their stores system and it has so far not been possible to determine its origin.

It should further be noted that this aircraft had no over-voltage protection unit and that aircraft of this type were not originally equipped with such units until after this particular machine was manufactured.

During the examination of the aircraft it was discovered that a number of fuses were incorrectly positioned (ie did not have correct ratings for the positions they occupied) and in particular the spare fuse, installed in flight after the initial radio failure, was of incorrectly low rating. It was also noted that the required ratings were originally annotated on the caps of the fuse-holders, which were otherwise identical and could be interchanged. The annotations had become illegible since manufacture.



**LEFT**

Unidentified Voltage Regulator  
Found in G-AYEY After Accident

**RIGHT**

Regulator Type Normally  
Installed In These Aircraft