

## CORRESPONDENCE

MANIFESTATIONS OF ST. ELMO'S FIRE  
IN A TROPICAL STORM.*To the Editor.*

May, 1945.

Dear Sir,—The following record may be of interest to many members of the Society:—

*Conditions Prevailing.*

On the night of 31st March, 1945, it was decided to fly non-stop from Pretoria to Kisumu, on Lake Victoria, Nyanza, a distance of some 1,850 statute miles. The route forecast for the hours of flight indicated a certain amount of high and medium cloud, but no serious meteorological hazards, and the aircraft was airborne at 20.00 hrs. G.M.T. Shortly before 01.00 G.M.T. on the 1st April, a long dark line of cloud, frequently illuminated by flashes of lightning, was discernible lying immediately across the track. An alteration of course was made to the east in an attempt to fly around the band of storms. After 100 miles on this track, it became obvious that the line of storms was in no manner abating, so it was decided to alter course again, and attempt to get through to the west. At this time the pressure altitude was 14,500 ft. above the M.S.L. datum at Pretoria and the outside air temperature was plus 8°C. As far as could be judged the vertical extent of the Cu. on this portion of the line was in the order of 25-30,000 ft., so it was impracticable to climb out above it, and it was equally impracticable to attempt to go underneath the cloud, as mountains up to 11,000 ft. rise out of a plain of a mean altitude of 4,000 ft. The new track to the west followed a line from the northern tip of Lake Nyasa to the southern tip of Lake Tanganyika. After flying some time on this track, it appeared that the best chance of getting through was midway between these two points as the cloud appeared lower and more broken, and lightning was less frequent.

Course was set accordingly, and the belt of cloud entered.

*The Storm Itself.*

At first only broken small Cu. was met with, but turbulence increased rapidly, and became most severe in the region almost clear of medium cloud between the main stormbelt and the broken Cu. just mentioned. The anvil from the main Cu-Nimb. now obscured the sky, and the absolute blackness was frequently illuminated by the constant lightning which threw the nearer clouds into relief against the background of the main storm. A portion dead ahead appeared to be free of lightning and it was decided to carry straight on. Just before the aircraft entered the cloud a blue corona-like discharge was visible around the periphery of the airscrews. As soon as the aircraft was in the cloud, turbulence increased slightly and the air temperature dropped to plus 3°C.

Immediately the corona discharge turned into a brush discharge, pointing forward, from all the protruding portions of the aircraft, the airscrews and spinners being affected particularly. This discharge was very inconstant, changing from a scarcely visible bluish ring around the airscrews to a brilliant display from every portion of the aircraft projecting forward and reaching a length of a foot or more. Then the discharge ceased altogether, and turbulence died down. A rapid rise was noticed on the altimeter, and also on the air speed indicator. A nearby flash of lightning illuminated the whole surrounding cloud, and the St. Elmo's Fire reappeared immediately, only this time in much greater intensity. The entire leading edge of the wing gave out a flat curtain of blue discharge, and the discharge from the engine nacelles and airscrews projected out forward as far as the front cockpit, tattered

## C O R R E S P O N D E N C E

bits of the discharge breaking away and "dissolving." Even projecting rivets inside the perspex observation dome and the wind-shield de-icing pipes gave rise to pennant-like discharges, and the actual nose of the aircraft seemed to be attached to a curling rope of blue flame stretching out ahead into the night. This all lasted perhaps five seconds, the phenomena rising in intensity, then suddenly the aircraft was struck by a direct flash. The noise gave the impression of a terrific explosion and the aircraft seemed momentarily filled with flame and blinding brilliance. It was several seconds before control was regained, and our eyes had recovered, and by that time all the signs of St. Elmo's Fire had disappeared. One further small discharge was visible comparable with the first corona manifestation.

### *Survey of the Damage Done.*

All radio and radar equipment was completely unserviceable, several electrical circuits had been put out of action, in particular those with long unshielded leads running the length of the aircraft. The flash appeared to have entered the aircraft on the starboard side of the nose and the tip of the starboard wing, where rivets and edges of the skin were pock-marked with small "spot-welds" from the passage of the flash. Several of these marks penetrated deep into the skin, and appeared to be flash-overs from poorly riveted (electrically) or poorly bonded portions of the structure. The de-icing device on this aircraft consists of a woven metal wick attached to the leading edges, and this was ruptured along its entire length, and the strands of metal blown back against the surface of the wing. They were too damaged by the slipstream to show what type of fusing had taken place. The leading edges of the wing were loosened on their rivets, and numerous other small structural faults were found, but none very serious. Two very remarkable points were, however, firstly that the compasses were only slightly affected, and secondly the Mk. IXa Bubble

Sextant hanging in the observation dome had all its electrical circuits fused together in a solid mass.

### *Further Remarks.*

It is considered that the aircraft, an Avro York 4-engined transport, acquitted itself remarkably well considering the severe strains to which it was subjected.

It would appear that merely earthing the radio equipment in an aircraft does not afford it much protection in the case of a severe strike by lightning.

The storm belt encountered would appear to have been associated with an inter-tropical front which had increased activity during the hours of darkness.

The passengers on this occasion were Field Marshal the Rt. Hon. J. C. Smuts and his Staff, on the first stage of their journey to the San Francisco Conference.

Yours faithfully,

T. G. E. COCKBAIN, A.R.Ae.S., F.R.Met.S.

*To the Editor.* 25/4/45.

Dear Sir,—I am in entire agreement with Major Green's correction of the very unrealistic \$600 per pound. The latter overlooks two important factors:—

- (a) That the carriage of an extra passenger normally involves an important addition to the empty weight of the aircraft.
- (b) That even if one extra passenger is carried in an aircraft, he still has to be advertised, arranged and catered for, looked after, etc., and that the cost of such services is extremely important in the U.S.A.

Even when these factors are accounted for and whatever assumptions are used, the potential value of weight saving is always very high.

As there is a danger that people may be tempted to save this valuable weight by sacrificing even more valuable aerodynamic or power plant efficiency, a warning of possible false economies will be given by