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DEPARTMENT OF SUPPLY

RESEARCH & DEVELOPMENT BRANCH

AERONAUTICAL RESEARCH LABORATORIES

Mechanical Engineering Technical Memorandum 142

A DEVICE FOR ASSISTING INVESTIGATION INTO AIRCRAFT ACCIDENTS

by D.R. Warren

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PROBLEM STATED

The occurrence of a number of major air disasters in recent months has emphasised the need for determining with the greatest possible certainty the cause of such accidents. This is particularly true in the case of aircraft in the early stages of development, or those incorporating radical advances in design, construction or performance. One can never overlook the possibility that these accidents may be due to some unforseen weaknesses inherent in the design, and liable to lead to further disasters before they are pinpointed and remedied.

This is well illustrated by the recent "Comet" disasters. It will probably never be known with certainty whether these were due to structural failure, meteorological abnormalities, error-of-judgment, overcontrol by the pilot or to some sudden event of which the crew could have no warning or knowledge, such as a fuel-tank or sabotage explosion. Nor is it known whether these disasters had any basic factors in common

In investigating such accidents, therefore, anything which provides a record of flight conditions, pilot reactions, etc. for the few moments preceeding the crash is of inestimable value.

PRINCIPLE OF THE SUGGESTED DEVICE

It may be assumed that in almost all accidents the pilot receives some pre-indication either by sight, feel of controls, automatic alarm or instrument reading. In most cases this would evoke a complaint of difficulty or a shout of warning to attract the attention of the co-pilot. Unless radio contact is actually in progress there is often not time to get any information through before the crash.

To preserve the valuable evidence offered by these few seconds conversation it is suggested that the following simple device could be fitted in all major aircraft, especially those in early stages of development. A small magnetic recorder could be made in which a continuous closed circle of steel wire passes an erasing head followed by a recording head in, say, a 2-minute cycle. Such a device would, therefore, provide a permanent "memory" of the conversation in the control cabin for the two minutes immediately prior to switching off, which would occur automatically in the case of an accident.

This period is probably all that is required to give a clue to the trouble encountered. In the case of fire the period would almost certainly contain a shout from the first crew-member to detect it, followed by verbal instructions. Careless control or error-of-judgment (as is often suspected in landing and take-off accidents) would probably elicit criticism, suggestion or warning from the co-pilot. An unexpected fuel-tank explosion would be recorded as an interruption of normal conversation by the

first part of the explosion noise followed by immediate cut-out.

SIZE, WEIGHT AND COST OF THE DEVICE

The instrument would be much less in size, weight and cost than a normal wire recorder since neither high fidelity nor play-back facilities are required, and the amount of wire needed is very small (e g 30 ft.). Power supply requirements would be low and could possibly be taken to some extent from the existing radio system. Members of A.R.L. Instruments Section have offered a rough estimate that the total weight (using existing power supplies) need not exceed 5 lb., the space less than 0.1 cu ft. and the cost of production (dozen lots) £60.

RECOVERY OF THE WIRE

The wire itself would not be greatly harmed by impact nor by suffering moderate heating, though the extent of the latter would need to be checked by experiment. There are, therefore, two methods of ensuring its recovery after an accident.

(i) The unit could be installed in the least likely part of the plane to receive extensive damage. The tail is suggested, as it is often thrown clear. Even in the event of fire it is usually the part least subject to intense heat.

(ii) The device could be so installed that in the event of an accident it would be thrown clear of the main body of the plane. This could be done by a small charge or mechanical ejector triggered by any of a number of possible events, e.g
   (a) Air speed rising above a maximum value
   (b) A jolt of more than, say, 10g.

(c) A break in any part of the control circuit.

(d) The attainment of a given temperature.

The first would cover most accidents in flight. Those on landing and take-off would be covered by the latter ones.

If the containing box were reasonably robust no parachute would be required, as only the wire need be salvaged. An attached marker streamer, however, would greatly help in finding the unit.

MAINTENANCE REQUIRED

Once installed the unit could virtually be forgotten. It could be automatically switched on with the engines and thus would not place any further burden on crew responsibility. An occasional check that it was in working order could easily be included in routine ground service procedure with the aid of a portable play-back device.

PSYCHOLOGICAL EFFECT

The possible objection by crew to having their conversation continually recorded is countered by the fact that the device has such a short memory. If no accident occurs, anything said during flight is obliterated during the time taken to taxi in.

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