

It should therefore be emphasized that the structural failure of the empennage a few seconds prior to impact merely affected the exact time and location of impact. Once control of pitch was lost, it was inevitable that the aircraft would crash, following a series of phugoid oscillations.

On the basis of the recorded cockpit conversation, it is obvious that the pilots were totally unaware of the existence of the inflight fire. This is readily understandable in view of the fact that the fire occurred within an area in which there were no fire sensing devices and thus no means by which a fire warning signal could be transmitted to the cockpit. The only result of the fire which manifested itself to the pilots was the loss of the hydraulic systems and the pitch control systems located in the empennage, a condition which, from the pilots' viewpoint, could have caused by a number of means other than a fire and which the pilots were therefore desperately attempting to troubleshoot. Even if the pilots had somehow deduced the cause of the control problem within the short time available, there was no remedial action which could have been taken, since the inflight fire area was devoid of any system for extinguishing a fire in flight.

2.2 Conclusions

(a) Findings

1. The crew was properly qualified and certificated.
2. Weather was not a causal factor in the accident.
3. The weight and c.g. of the aircraft were within limits at takeoff from Elmira and, on the basis of available evidence, were computed to have remained within limits until the empennage disintegrated in flight.

4. The engines were developing a high level of power at impact and the APU was rotating at near governed speed.
5. There were no structural or systems failures other than those associated with the inflight fire.
6. There was an inflight fire which originated in the airframe plenum chamber, burned through to the hydraulics compensator bay, and thence up into the vertical fin.
7. The mechanism which initiated the sequence of events leading to the fire was a malfunctioning nonreturn valve which allowed engine bleed air to flow back through an open air delivery valve, through the APU, and exit into the airframe plenum chamber at elevated temperatures.
8. The temperatures introduced into the plenum chamber by reverse air flow were sufficiently elevated to cause the acoustic blankets lining the chamberwalls to self-heat to ignition.
9. The primary combustible fueling the fire was hydraulic fluid, which was fed to the fire under pressure when the flexible hoses in the hydraulics bay failed due to excessive heat.
10. The fire burned intensely from the fuselage up into the vertical fin due to the updraft and the built-in chimney which existed in that area.

11. The fire destroyed the elevator control rods, the electric elevator trim lead, and both hydraulic systems, thus causing the pilots to lose all control of the pitch of the aircraft.
12. The fire ultimately weakened the lower rudder attach fitting and the vertical fin spars to the point where those components failed under normal aerodynamic loading and the rudder, top two feet of the vertical fin, and horizontal tailplane separated in flight.

(b) Probable Cause

The Safety Board determines that the probable cause of this accident was the loss of integrity of the empennage pitch control systems due to a destructive inflight fire which originated in the airframe plenum chamber and, fueled by hydraulic fluid, progressed up into the vertical fin. The fire resulted from engine bleed air flowing back through a malfunctioning nonreturn valve and an open air delivery valve, through the auxiliary power unit in a reverse direction, and exiting into the plenum chamber at temperatures sufficiently high to cause the acoustic linings to ignite.