QUARTERLY

of the NATIONAL FIRE PROTECTION ASSOCIATION

Vol. 40 April, 1947 No. 4

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Subscriptions to the QUARTERLY are accepted only as a part of the general publications of the Association which are sent to members. Associate membership is open to anyone interested; annual dues $10, of which $5 is for subscription to the QUARTERLY.

Entered as second-class matter December 15, 1908, at the Post Office at Boston, Mass., and Framingham, Mass., under act of March 3, 1879.

Can Aircraft Crash Fires be Prevented?

By George H. Tryon, III,
Secretary, N.F.P.A. Committee on Aviation and Airport Fire Protection.

There is no justification for viewing fire as the inevitable result of aircraft crashes. Those engaged in fire prevention work know that cures do exist for fire causes. Whether these cures are simple or complex, fires can be prevented.

In aircraft crash fires, prevention depends upon the determination of the aeronautical engineer to provide the necessary safeguards. This is comparable with the architect's responsibility to design fire-safe structures.

The inherent nature of aircraft has given rise to the general misconception that the impact fire problem defies solution. This reaction should not be dismissed without pausing to inquire as to its validity.

Obviously, placing tremendous quantities of gasoline in frail containers directly behind high horsepower reciprocating engines, adding the lubricating oil and hydraulic fluids, the electrical, exhaust and heating systems, the cargo and passenger compartments, the auxiliary power units, galleys and batteries, truly produces a fire-wise monstrosity. It is to the everlasting credit of the aeronautical engineer that he has done all this, added the human factor, and produced something that flies, is safe to fly, and has a fire record in flight that is remarkable when viewed from the constituents that make the hazard.

It is at the time of impact, at the time of collision with an irresistible force, that all the skillful engineering of the aeronautical engineer goes "by the board." Then, all these potential hazards are placed in juxtaposition, and, in such proximity, become essentially uncontrollable, or, at least, unpredictable, and highly explosive.

The Cures.

Breaking down the problem into its component parts is the most apparent way of seeking a solution. Obviously, the gasoline involved is the number one hazard. Aviation "high-flash" fuel is the only answer. To be sure, there are practical problems in its utilization and there is no desire to minimize these problems. Without discussing such factors here,* it is safe to say and logical to advance that the employment of "high-flash" fuels is obligatory for fire safety in aviation. The recent tragic catastrophes provide sufficient evidence to require this added degree of safety.

A non-flammable hydraulic fluid is the second essential. Present-day hydraulic fluids which ignite readily from the heat of an engine or from the spark of a broken electrical circuit constitute an ignition potential as well as a combustible element. Research to develop a non-flammable substitute is progressing favorably under the guidance of the Civil Aeronautics Administration.

The burning characteristics of aircraft lubricants have nothing to do with their functional use. It is reasonable to expect that future research will also develop a non-flammable substitute for such hydrocarbons. Iodine inhibitors to retard combustion of lubricants also possess considerable promise.

*See Bulletin No. 7, N.F.P.A. Committee on Aviation and Airport Fire Protection.

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Even where fire equipment is available, crash fires are often of such magnitude that control cannot be established in the time necessary to rescue all occupants. On Sept. 24, 1946, this B-25 crashed at Washington National Airport and burst into flames immediately, causing the death of four occupants. Fire fighters were able to drag two men from the burning wreckage and saved their lives.

This Navy hospital plane, executing a radar-controlled landing at the Oakland, Calif., Municipal Airport on January 20, 1947, undershot the field and struck an embankment. The fuel tanks were split open, fuel lines ruptured, and electrical circuits exposed. The resultant fire could not be extinguished, despite adequacy of equipment, because of terrain difficulties and the constant reignition of vapors by burning magnesium alloy parts. One person was killed, three suffered major burns, and eighteen, thrown clear of the fire area, suffered injuries.

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Fire in flight, caused by failure of the generator lead-through stud installation in the fuselage skin of the forward baggage compartment, caused this accident. Ignition of hydraulic fluid was a predominating factor in the extent and rapid spread of fire which prevented control at incipiency. Air flow in the interior of the aircraft spread the flames into the cockpit when one of the crew went to investigate smoke through the access opening. The accident occurred on July 11, 1946, at Reading, Pa.

Fires at time of ground impact are not limited to large aircraft. Pictured below is the burning wreckage of a Model D 18S, single engine, two-place Beechcraft which crashed at Wichita, Kansas, on April 7, 1946. An estimated 286 gallons of gasoline were involved in the fire. The two persons killed, in this case, were thrown clear of the wreckage and landed in a gasoline spill which ignited instantaneously. One passenger miraculously escaped.

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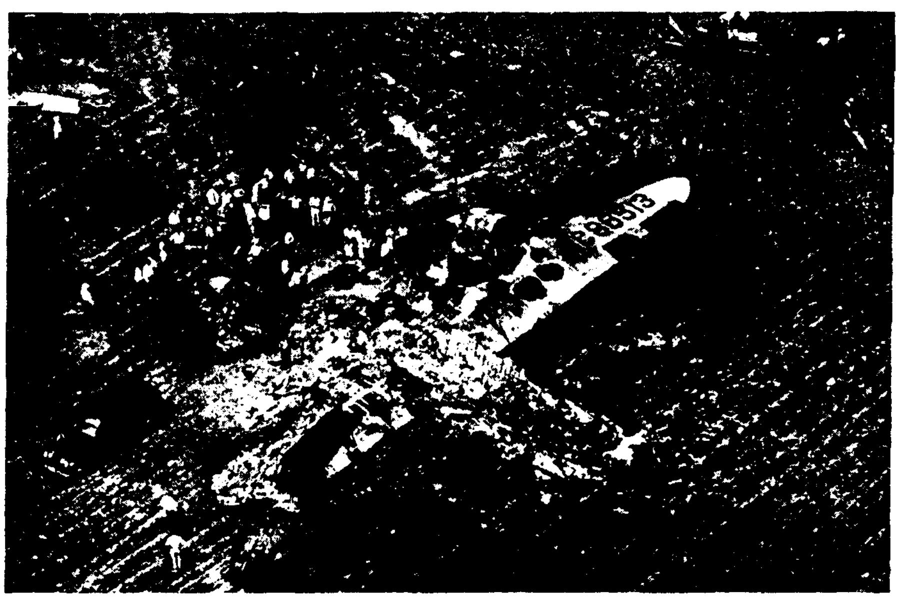

Flammable materials used in aircraft cabins and compartments in the form of soundproofing materials and upholstery are, of course, unnecessary combustible elements. Positive attacks on this hazard are being taken today with effective results. Where non-combustible materials are not employed, flame-retardant treatments are given to fabrics with effective results.

Even with "high-flash" fuels, there also exists the need for crash-proof fuel tanks, fire-resistant aircraft plumbing, and automatic fire protection. As the term "high-flash" implies, the fuel is merely less hazardous than conventional aviation gasolines. Once ignited, it will burn and burn readily and, because of properties peculiar to its employment in aircraft, there remains an explosion potential under certain adverse conditions.

The use of integral fuel tanks (where the wing itself constitutes the tank) should clearly be eliminated. Experience has shown that sealing such tanks to prevent leakage cannot be guaranteed because of stress and strain accompanying impact forces and high vibrations. Flexible steel, flammable liquid plumbing must replace present types of tubing, and such materials are available.

Fire extinguishing equipment provided for aircraft must incorporate impact actuators which flood potential danger zones with an inert or fire blanketing gas, stop the power plant and operate the battery cut-off switch. This provision, while sounding like "protection," actually is "prevention."

Engineered air-flow control inside aircraft (to prevent drafts) and compartmentation of both passenger and cargo areas are necessary for safe ventilation and segregation of combustible materials. Effective fire bulkheads in strategic locations would confine a fire to its place of origin.

Moving the landing gear inboard and strengthening the fuselage to absorb the shock of landing would eliminate applying stress to the fuel tank supporting structure. This revision of the commonplace has been accomplished in the Burnelli "lifting wing" design. Another feature of this latter type aircraft is the shifting of fuel tanks so that they are not in direct line with the power plants and their exhaust outlets.

Conclusions.

These are a few of the fire prevention measures that can be taken by aeronautical engineers to eliminate fires at the time of ground impact. They are some of the points which the N.F.P.A. Committee on Aviation and Airport Fire Protection* is investigating in an effort to increase fire safety for air transportation. The program is undertaken in the realization that our future is in the air and that it must be safeguarded.

**Aeronautical Organizations Participating*—Aircraft Industries Association, Aircraft Owners and Pilots Association, Air Ministry Fire Services (Great Britain), Air Transport Association, American Association of Airport Executives, Army Air Forces, Bureau of Aeronautics—Navy Department, Civil Aeronautics Administration, Civil Aeronautics Board, Institute of the Aeronautical Sciences, National Aeronautic Association, National Association of State Aviation Officials, Port of New York Authority, Royal Canadian Air Force.

Advisory Organizations—Daniel Guggenheim Aeronautical Laboratory, International Aviation Organization, National Advisory Committee for Aeronautics.