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Conceptual Design of Fuel Dumping System in Aircraft

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Conceptual Design of Fuel Dumping System in Aircraft

Cover Page Footnote

Naveen M Kumar, Conceptual Design of Fuel Dumping System in Aircraft (Tamil Nadu, Excel Engineering College, 2022)

Fuel jettisoning has always been an option for commercial airlines, in an acknowledgment of an in-flight emergency or an unforeseen operational requirement. It is typically jettisoned to reduce the weight of the aircraft and increase the probability of a safe landing. Every year, aircraft dump thousands of gallons of aircraft fuel into the atmosphere. Fuels are released at a specific height by using set calculations. As per the calculation, the fuel evaporates before reaching the ground. If aircraft occasionally establish hydrocarbons by jettisoning fuel at low altitudes in the troposphere, there is only a small increase of hydrocarbons in the region as the fuel evaporates. However, if the aircraft fuel contacts the ground, there is a potential for negative environmental consequences such as crop damage or water pollution (Clewell & Good, 1980; Good & Clewell, 1980).

Aircraft use their fuel dumping system to jettison fuel. This system includes several types of valves and pumps. Pilots manage the fuel dumping itself by flipping a switch in the cockpit to initiate the jettison (dump) system. Once the system is ON, fuel is pumped out via valves placed in the wings. Fuel dumped into the atmosphere will naturally evaporate.

We worked on this project to rescue the fuel from jettisoning in the atmosphere by using the external rubber tank. The external tank with parachutes is placed on a fuel-exiting valve on the wing. After filling the tank, the tank is released into the atmosphere. The rubber tank is located and rescued by using the GPS fixed to the parachute bag.

Fuel Dumping

Fuel jettison is the intentional, controlled, removal of fuel from an aircraft while airborne. Not all aircraft styles contain a fuel jettison capability - larger aircraft typically have jettison systems while smaller aircraft may not have a jettison system.

The pilot jettisons fuel to reduce aircraft weight. This situation can arise for a number of reasons, such as after an engine failure or a medical situation. For these situations, the pilots may decide to reduce the aircraft weight below maximum certified landing weight because of decision to return to the departure airport or initiate a diversion to a different airport.

Impacts

If the liquid fuel contact with the earth, there is a possibility of negative environmental issues like crop injury or pollution. Jet fuel is created of very different venomous hydrocarbons as well as benzyl that have joined to cancer; however, it conjointly carries a variety of additives in addition to biocides to manage microorganism and fungous development in craft fuel systems (Quackenbush et al., 1994). Thus, there would make certain hazards if these classes of chemical mixtures encountered areas such as water resources, farmland, or urban housing.

Problem

The potential hazards associated with fuel dumping process are soil pollution, water pollution, and it causes several skin disease and eye rachis for human beings and animals. In addition, due to fuel dumping, the airlines incur huge monetary loss on it.

Purpose

The purpose of this study was to rescue unburned fuels from dumping process. It reduces the soil pollution, crop damage, water pollution and saves human beings from several diseases and eye rachis. In addition, it saves airlines from monetary loss and increases their profits.

Methodology

Pilots determine whether or not they need to dump fuel. Coordinating with air traffic control, pilots initiate the dumping procedure. When the pilot switches the fuel dumping system ON, unbound fuels travelled from tank to jettison value by several pipelines.

A small pipe-like section with an external rubber tank and parachute mounted at the end of the jettison nozzle in the wing. The external rubber tank placed inside the pipe by folding into small size and the small parachute connected with it. The unburned fuel is received in an external fuel tank. Once the fuel is reserved in an external tank, the tank is released into the atmosphere. A parachute placed on the external tank allow it to safely fall to the earth. After the aircraft lands at the airport, the external fuel tank rescued by using the GPS or another navigation system. Now, we can reuse the fuel saved from dumping. It reduces the airline's fuel cost and pollution caused by jet fuel.

The external fuel tank is prepared by using the rubber material of Butyl rubber with three layers for effective landing to avoid the exposing on landing period (Hachette Filipacci, 2009). The capacity of external fuel tank capacity is 10,500 L; it may change based on aircraft fuel capacity.

Figure 1
Fuel Dumping System Process

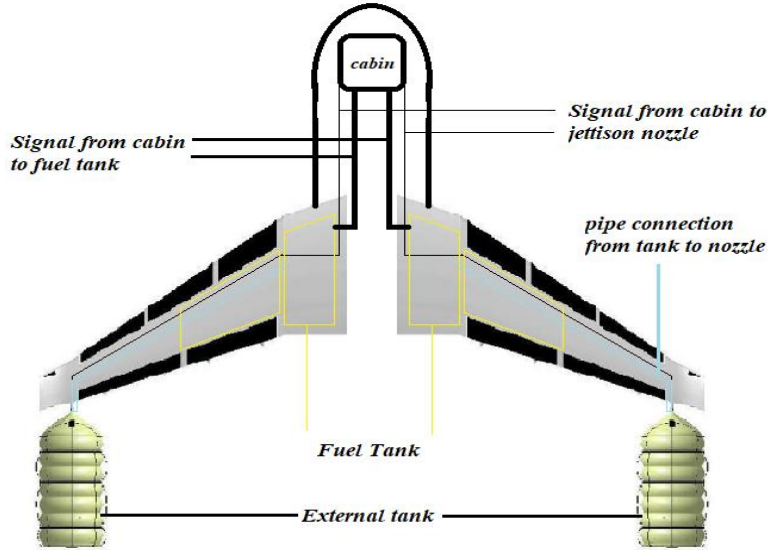


Figure 2
Model of the Wing with Folded Fuel Tank and Parachute.

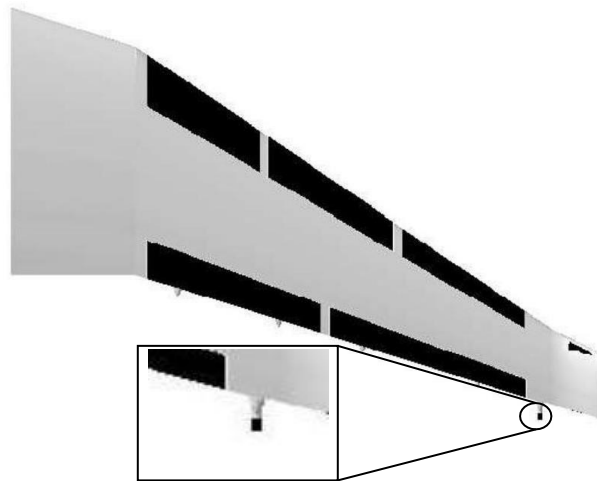


Figure 3
Fuel Filled External Tank

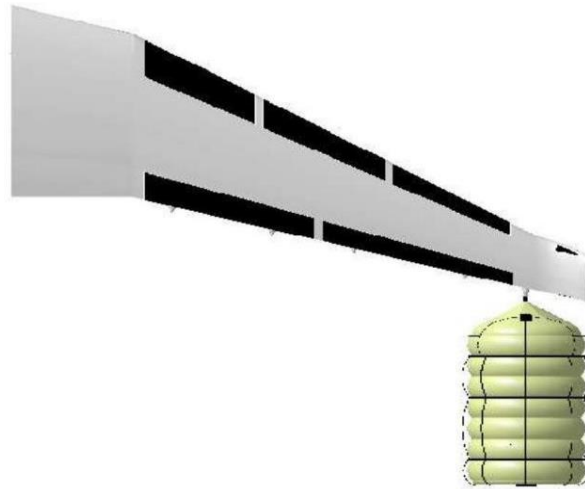


Figure 4
Cross-Section View

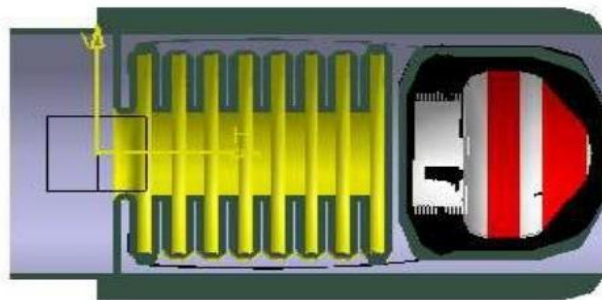


Figure 5

External Fuel Tank Released over the Atmosphere



Conclusion

The project from our mind finally used to secure and save the environment and atmosphere and to consume the fuel cost in airlines. Our idea saves the unburned fuel of aircraft from dumping over the atmosphere by adding a temporary fuel tank manufactured with rubber on the jettisoning nozzle. The unburned fuels filled over the rubber tank and released over the atmosphere with a parachute for a safe landing. The temporary tank released on nearby the airport for the easy rescue operation. The tank is located by using the GPS, which mounted in the parachute bag. This project avoids the environmental hazards caused by unburned fuel by mixing on air, the water of lack, sea, and river and secures the living things from skin allergies and disease. In addition, it consumes and saves the cost of fuel on airlines and increases their profit.

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