AMERICAN AIRLINES SYSTEM

AMERICAN AIRLINES, INC. • AMERICAN OVERSEAS AIRLINES, INC.

LA GUARDIA FIELD • NEW YORK AIRPORT STATION

OFFICE OF
THE VICE PRESIDENT - ENGINEERING

December 18, 1947

Dear Mr. Carter:

Mr. C. R. Smith has asked me to write you a summary of the findings in connection with the DC-6 fires which resulted in the temporary removal from service of those airplanes and the work which must be accomplished before they can be returned to operation.

I hope the attached explanation will be clear to you.

Sincerely,

William Littlewood

William Littlewood

Mr. Amon G. Carter
Fort Worth Star-Telegram
Fort Worth, Texas

December 18, 1947

# DC-6 FIRES

Our Gallup, New Mexico, forced landing following a fire in the air, and the United Air Lines Bryce Canyon accident following an apparently similar experience of much greater intensity, were analyzed together and the necessary action was determined, based on both experiences. The evidence from the Gallup incident was quite complete and the findings were therefore conclusive. In the Bryce incident, a great deal of physical evidence and testimony was, of course, missing but certain differences in the apparent progress of the fires, based on the reconstructed evidence, were, it is believed, satisfactorily accounted for by two basic conditions of the respective fires. In the Bryce incident, the airplane was pressurized and the flares were installed, at least one flare apparently contributing to the early severe intensity of the fire. In the Gallup incident, the flares had been removed and the airplane was unpressurized. It is believed, however, that the major source of fuel and the primary source of ignition may well have been the same for both fires.

If you will refer to the attached diagrams - Figures 1, 2, and 3 - I will endeavor to explain the location and nature of the fires. Figure 1 shows the general location of the under-floor compartments, notably the forward and aft baggage compartments; the hydraulic accessories compartment; the boiler room, which houses the supercharger after-cooler, oil cooler, expansion turbine, cabin heater, and associated duct work and which locates the focal point of the fires. Through the boiler room ducts all ventilating air from the superchargers or outside airscoop - cooled or heated as required - passes on its way to the cabin and cockpit from which it thereafter proceeds again through the boiler room outside the ducts, exhausting to the atmosphere through a regulating outlet. On the bottom of the fuselage at the boiler room location, there is a ram airscoop (Figure 1) which supplies cooling air to the supercharger after-cooler and oil cooler, and also supplies combustion air to the cabin heater. This combustion air is, of course, entirely separate from the ventilating air which passes through the boiler room ducts and after burning in the cabin heater, is dumped overboard through an outlet also on the bottom of the airplane. To further understand the events, it is now necessary to refer to Figures 2 and 3.

Figure 2 shows the fuel system of the airplane which involves a number of tanks located throughout the wings. There are four main tanks (one per engine) and four alternate tanks. These tanks are interconnected by valves and pipes so that fuel from any tank can serve any engine. There are in the system several booster pumps which serve to supply a full flow of fuel as required. These booster pumps may also serve as transfer pumps and have been commonly used to move fuel from one tank to another to compensate for variable usages or quantities. Each fuel tank is, of necessity, fitted with a vent outlet to allow the passage of air as tanks are filled or emptied. These vents have been located on the airplane as indicated in Figure 2, the locations being influenced to some extent by the necessary external pressure conditions to secure proper fuel tank operation. The fuel vent outlet for number three alternate fuel tank was located on the right lower side of the fuselage, almost immediately at the junction with the airplane wing.

Figure 3 shows the relationship on the underside of the airplane between the number three alternate fuel tank vent and the ram airscoop under the boiler room. The investigation indicated that in the Gallup incident, on transfer of fuel to number three alternate tank, there resulted an over-flow from the tank vent and the passage of fuel underneath the airplane entering the ram airscoop and, in turn, the cabin heater system. The legitimacy of such an occurrence was established by test flight demonstration. It was also established by ground tests that with such a condition, the turning on of the cabin heater, as was done immediately prior to the Gallup fire, could result in a backfire and the establishment of a severe fire inside the forward end of the duct and rear end of the ram airscoop, which area was entirely constructed of aluminum, and which resulted in prompt burning through of the duct, admitting raw burning gasoline to the boiler room. The progress of the fire after this was through and near the ventilating air outlet from the boiler room and resulted in the burning through of ducts, fuselage skin, and structural elements, centered in the right forward corner and bottom of the boiler room.

Two obvious corrections are required to insure against a repetition of such an incident. First, the alternate tank vent must be relocated to a safe place. This is being accomplished and along with it, all other tank vents will eventually be relocated in the outboard wings. The second obvious change is the relocation of the ram airscoop insofar as it serves as an intake to the combustion heater. This intake will be placed in the leading edge of the wing forward of any possible flow of fuel. The intensive investigation naturally disclosed a number of other items to be improved, some of which were considered mandatory before flight -- most of which, however, are listed as ultimately desirable. Such changes include the increase of fire detecting devices and fire extinguishing capacities, and installation of access windows to the underfloor compartments. Another change involves the reworking of all heater accessory units to provide additional safety features and the provision of supplementary emergency shut-off devices in the possible event of heater mal-functioning. Numerous detailed improvements will eventually be made in electrical installations and equipment. The application of numerous drains and dams to restrain possible inflammable fluid leakages will also be accomplished. The eventual program will also involve the widened application of stainless steel and fire resistant materials in numerous areas and the development of an improved supercharger and its oil cooling installation. There are, of course, innumerable minor improvements which have crept into the program but the time required for earliest possible return to service is established by the first item listed above; namely, the relocation of vents and cabin heater air intake, and improved fire detection and protection in the under-floor compartments. The program is being worked on with the greatest intensity and all the agencies involved have been extremely cooperative in helping to resolve and expedite the program. Pending the possible development of satisfactory protection devices, fuel transfer has been prohibited for both DC-4 and DC-6 airplanes.

Airplanes may be returned to service in three basic conditions; namely, pressurized without heat - for those who can use such simplified operation; heated without pressure - which is the minimum condition which American Airlines can consider at this season; and eventually, heated and pressurized - which will require, of course, the largest bill of work. Our present efforts are bent towards the earliest possible return of the DC-6's to service with all necessary safety features to provide heat without pressure, expecting shortly thereafter to restore full pressurized operation.

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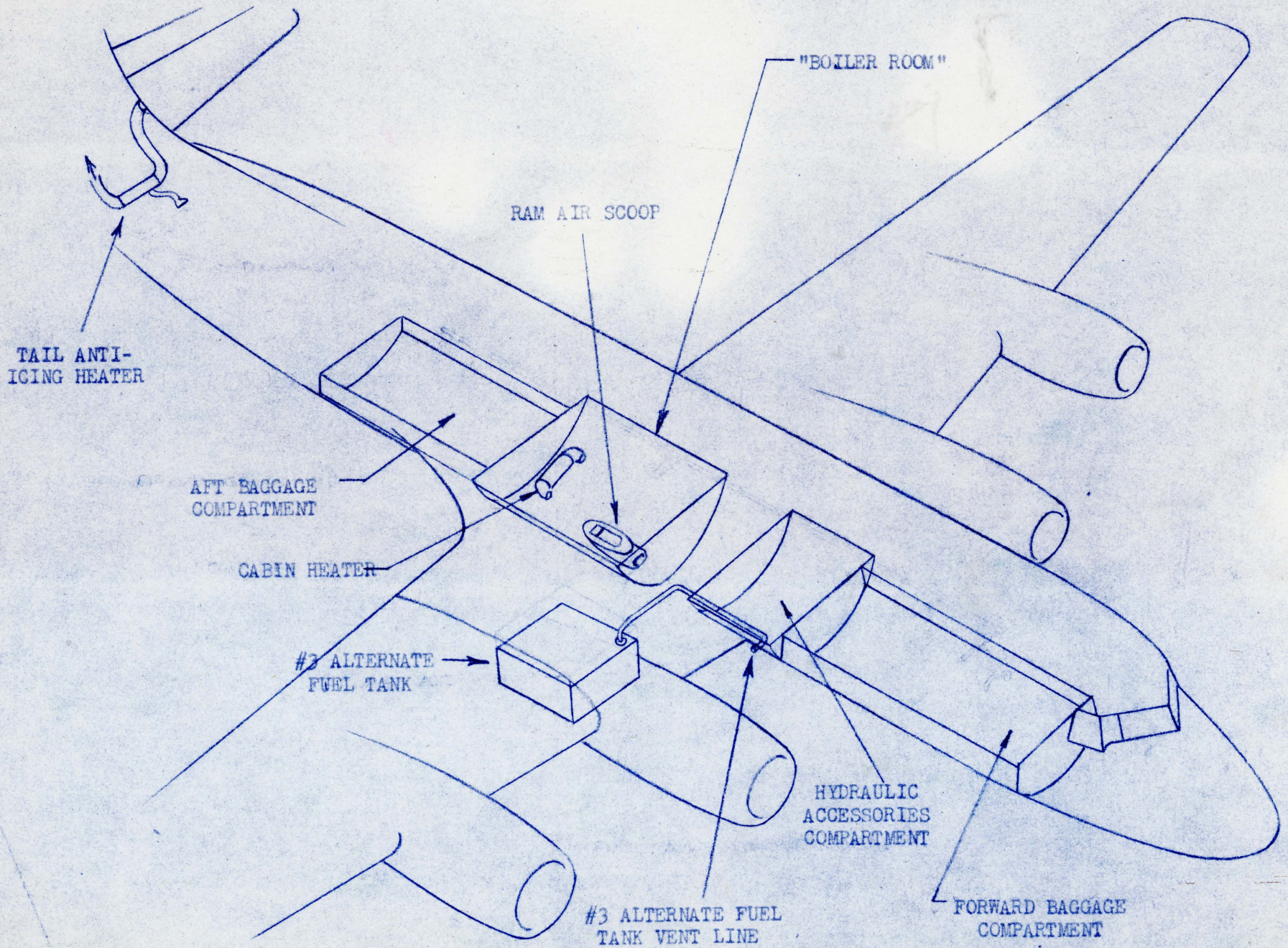
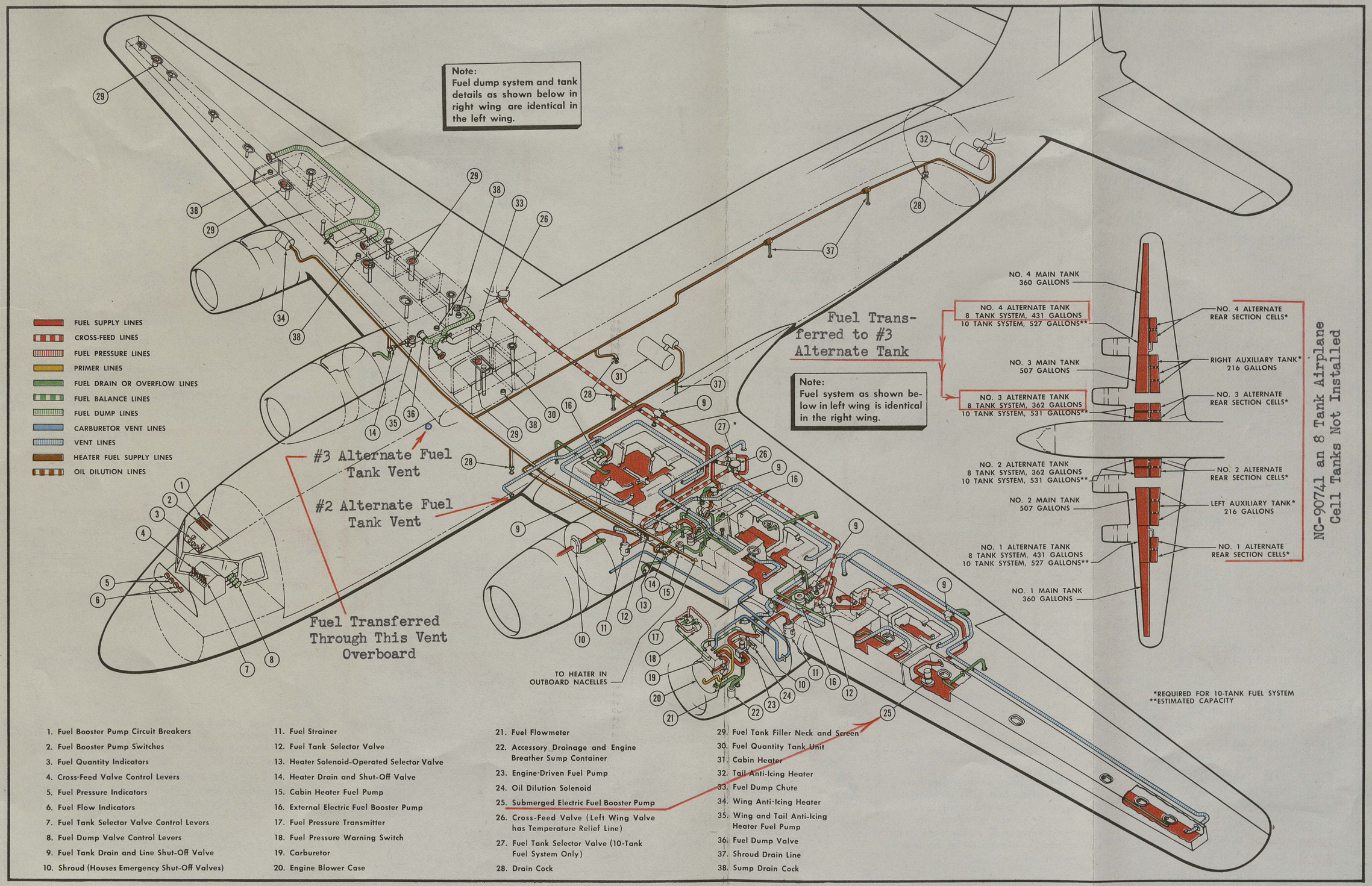
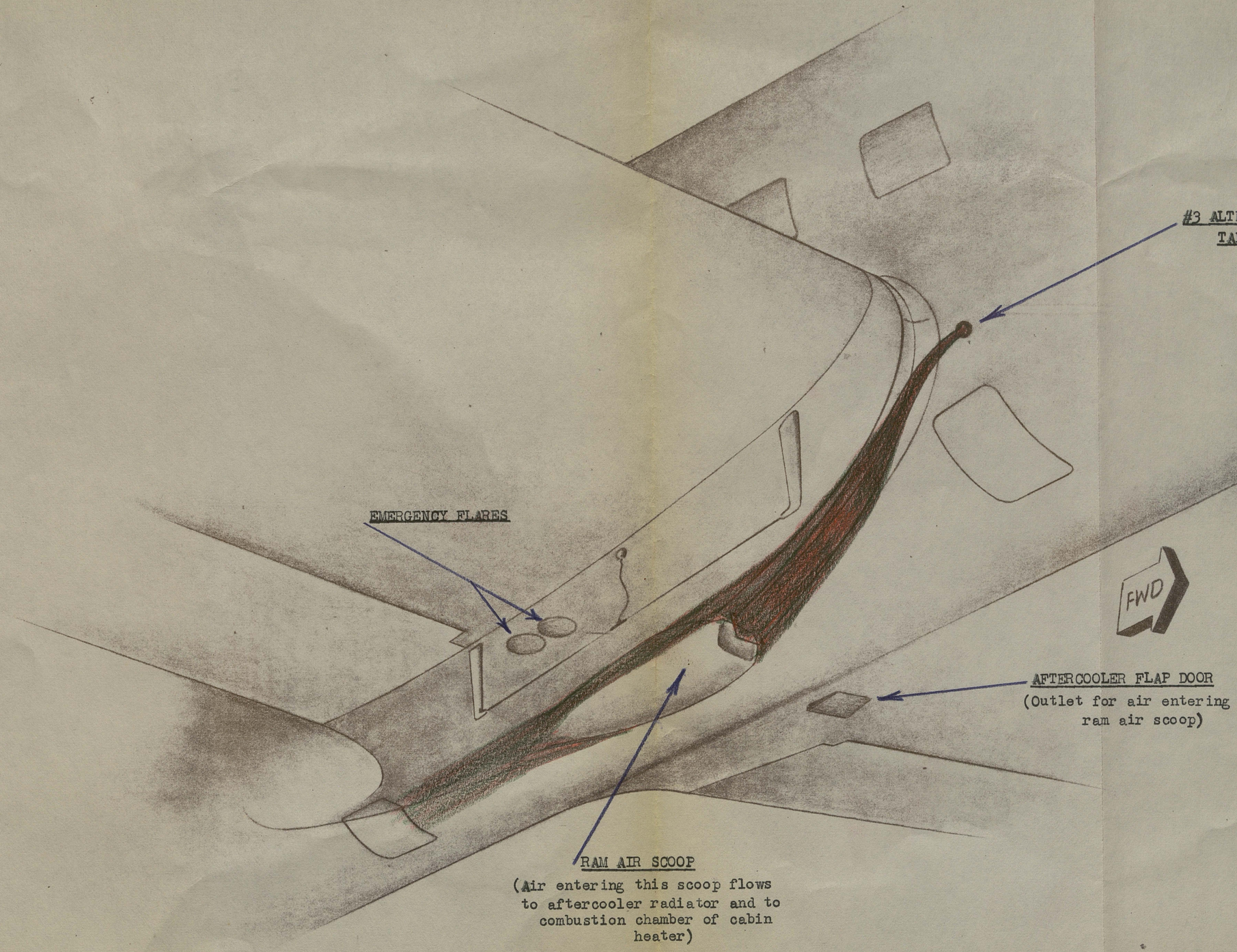

"BOILER ROOM"
RAM AIR SCOOP
TAIL ANTI-
ICING HEATER
AFT BAGGAGE
COMPARTMENT
CABIN HEATER
#3 ALTERNATE
FUEL TANK
HYDRAULIC
ACCESSORIES
COMPARTMENT
#3 ALTERNATE FUEL
TANK VENT LINE
FORWARD BAGGAGE
COMPARTMENT

Figure 1




1. Fuel Booster Pump Circuit Breakers
2. Fuel Booster Pump Switches
3. Fuel Quantity Indicators
4. Cross-Feed Valve Control Levers
5. Fuel Pressure Indicators
6. Fuel Flow Indicators
7. Fuel Tank Selector Valve Control Levers
8. Fuel Dump Valve Control Levers
9. Fuel Tank Drain and Line Shut-Off Valve
10. Shroud (Houses Emergency Shut-Off Valves)
11. Fuel Strainer
12. Fuel Tank Selector Valve
13. Heater Solenoid-Operated Selector Valve
14. Heater Drain and Shut-Off Valve
15. Cabin Heater Fuel Pump
16. External Electric Fuel Booster Pump
17. Fuel Pressure Transmitter
18. Fuel Pressure Warning Switch
19. Carburetor
20. Engine Blower Case
21. Fuel Flowmeter
22. Accessory Drainage and Engine Breather Sump Container
23. Engine-Driven Fuel Pump
24. Oil Dilution Solenoid
25. Submerged Electric Fuel Booster Pump
26. Cross-Feed Valve (Left Wing Valve has Temperature Relief Line)
27. Fuel Tank Selector Valve (10-Tank Fuel System Only)
28. Drain Cock
29. Fuel Tank Filler Neck and Screen
30. Fuel Quantity Tank Unit
31. Cabin Heater
32. Tail Anti-Icing Heater
33. Fuel Dump Chute
34. Wing Anti-Icing Heater
35. Wing and Tail Anti-Icing Heater Fuel Pump
36. Fuel Dump Valve
37. Shroud Drain Line
38. Sump Drain Cock

***Figure 10 — Fuel System Diagram***


#3 ALTERNATE FUEL TANK VENT
EMERGENCY FLARES
FWD
AFTERCOOLER FLAP DOOR
(Outlet for air entering ram air scoop)
RAM AIR SCOOP
(Air entering this scoop flows to aftercooler radiator and to combustion chamber of cabin heater)