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Intensified development and research to solve the many problems created by jet transport are urged by M. G. Beard, Chief Engineer of American Airlines, in an article in the current issue of the quarterly publication, Air Affairs, of the American Society of Air Affairs.

"The jet and its engine are basically simple," Beard writes, "yet the safe and economical operation of both will depend completely, to an extent never before experienced, upon the reliable operation of a host of complex auxiliary devices. This, perhaps more than any other factor, explains the reluctance of United States airlines to purchase jet transports."

The new problems presented by jets, according to Beard, involve engine installation, radar equipment, pressurization systems, refrigeration systems, flaps and auxiliary lift devices, landing gear and exterior surfaces and seals.

Beard declares that jet engines must be located away from passenger seats, fuel tanks, controls and other vital equipment as a precaution against consequences of an engine failure. Noting that energy stored in moving parts of a piston engine is generally small, except in the case of the propeller, Beard points out that jet engines contain parts of considerable size having tangential velocities of nearly 1,000 miles an hour. The light shell of the engine itself will not stop fragments of a failed compressor or turbine wheel, he warns.

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Since half the jet engine is filled with a continuous flame, fed with large quantities of fuel at high pressure, a blowtorch effect would penetrate any rupture resulting from a turbine wheel failure, he says.

"The highest order of fire protection must be installed and rigidly maintained, especially when the jet engine is installed in the fuselage or in the wing structure as planned in current design proposals," he writes.

Airborne radar is a must in jet airlines to identify and avoid storm centers, he continued. Conventional aircraft encountering hail of any substantial size at 300 miles an hour suffer severe damage.

"Inadvertent flight into a severe hailstorm at 500 miles an hour might well result in loss of the airplane," Beard warns. "It now appears possible, with suitable airborne radar, to identify and avoid storm centers by adequate margins."

Unfailing pressurization must be assured to enable the jet airliner to operate at its efficient altitude of 30,000 to 40,000 feet on long flights.

"Jet fuel consumption is increased so drastically at low altitudes that the longer flights cannot be flown with jet airplanes operating at altitudes where cabin pressurization is not required," Beard reasons. "Depressurization of the cabin in the middle of a long flight will force an unscheduled landing, because of range limitations, if for no other reason."

Because explosive decompression at such high altitudes is so much more serious, the fuselage must be stronger.

Since in jets now proposed cabin heating is by air bled from the jet engine compressors, air-conditioning will no longer be a luxury but a necessity. The temperature of air bled from the compressors must be reduced to a point bearable to passengers.

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"Dive brakes and wing spoilers are required to permit rapid descent from high altitude at reasonable airspeeds," Beard continues. "These design features are not individually frightening, but collectively they spell complexity and increased maintenance to the operator."

Braking on landing also presents a problem to the airline operator. Reversible pitch propellers and wheel-brakes have made landing procedures of the current airliner truly flexible. Beard advocates energetic development and evaluation of "the reversible jet tailpipe . . . as a means of overcoming an important deficiency in the practical airline jet transports."

Increased maintenance on exterior surfaces and seals of the jet aircraft will almost certainly be required because of the high speeds.

"Cruising speed losses upward of 6 per cent have been discovered in present transport airplanes, and have been traced to deterioration of aerodynamic seals, with subsequent leakage and spoiled airflow," Beard explains. "For a large jet transport on a transcontinental flight, a loss of this magnitude would require an additional ton of fuel to be carried, which would, in all probability, be subtracted directly from payload."

Beard concludes that the airlines, concerned mainly with safe, reliable and economical operations, will be reluctant to place fleet orders until the problems created by the jet have been in a large measure answered and the airplanes have reached the stage of reliability commensurate with present operating equipment.

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