Airplanes and Cancer: A New Jet Needed

Jet engines are so capable of damage to the earth's protective ozone layer that completely redesigning them will probably be necessary. Without this redesigning, or the strict limitation of fleet sizes, many more persons will contract and die of skin cancer each year.

These cheerless predictions are contained in a report of the National Research Council's Climatic Impact Committee, just released. The report comes as a contradiction, at least in spirit, to another report on the impact of stratospheric flight released by the Department of Transportation in late January. Both studies were begun after Congress deferred the development of a U.S. SST fleet in 1971, based on early suspicions of ozone destruction by jet engine exhausts. The DOT study assigned numbers to the probable ozone depletion that were a factor of two smaller than the current NRC study, and many interpreted the DOT study as an exoneration of stratospheric flight. But both studies, conducted by experts in the fields of atmospheric science, aeronautics, biology and medicine, confirm the earlier theory that the ozone layer is being depleted and call for a redesign of jet engines if passenger plane fleet sizes are to be increased over the next two decades.

The problem arises because jet engines emit certain combustion products into the ozone layer in the stratosphere. The jet combustion products, nitric oxide (NO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and sulfur trioxide (SO_3), affect the stratosphere in two ways. The nitrogen compounds react with ozone molecules, catalyze their breakdown into molecular oxygen and allow more ultraviolet light to reach the earth. The sulfur compounds form particles which can block out some of the beneficial solar radiation and may affect climate and agriculture.

NRC panel member Frederick D. Rossini said at a press conference this week that the nitrogen compounds are formed at very high temperatures in the engines, above 1800 degrees K. The engines could be redesigned to burn at lower temperatures, he says, to reduce the emission of nitrogen compounds. The sulfur oxides are formed with sulfur contaminants in jet fuel and these could be removed during petroleum cracking, Rossini says.

The effect of airliners on stratospheric ozone has been small so far, less than a one percent reduction, but could get much greater, the report states.

The addition of 100 present-day supersonic airliners (like the Anglo-French Concorde or the Soviet TU-144) would decrease the ozone by 0.7 percent and increase skin cancer by 1.4 percent per year. That would mean about three new cases of skin cancer per year per 100,000 Americans. A fleet of 300 to 400 of the larger supersonic airliners (the type deferred by Congress) would have caused about a 10 percent reduction in ozone and a 20 percent increase in skin cancer cases per year.

J. Weinberg

Booker, (right) and NRC committee members present tough recommendations at a press conference this week.

These ozone depletion figures are separate from estimated depletions due to aerosol propellants and other halogenated hydrocarbons. With unlimited growth of SST fleets (with current engine design) and unlimited growth in the use of aerosol propellants, study chairman Henry G. Booker of the University of California at San Diego says, there could be a 40 to 60 percent decrease in the ozone layer by the year 2000, with disastrous consequences for human health, agriculture and climate.

The NRC Climatic Impact Committee recommends several actions to avert the possible damage by jet exhausts. (They are currently studying aerosol propellants.) A large research and development program, costing perhaps $100 million, should be devoted to creating jet engines with reduced nitrogen oxide emissions. Research at the NASA laboratory in Cleveland, New York University and elsewhere has already produced experimental fuel-injection systems that reduce emissions by a factor of 10 or more. Another recommendation is the removal of sulfur from jet fuels. The committee also calls for international cooperation in setting strict emission standards for aircraft and monitoring the effects. The international effort could be coordinated by the International Civil Aviation Organization, they state, and emission standards and monitoring could be the responsibility of the World Meteorological Organization. The committee also recommends additional research in several areas: the cause of skin cancer, the mixing of atmospheric layers and basic atmospheric chemical reactions, and the biological effects of stratospheric modification. □

NSB: Science's solemn prospect

The current American research effort, according to the annual report of the National Science Board, is "inadequate to prepare the nation for the challenges which are now emerging." Between 1970 and 1974, the board noted, total funding of basic research from both public and private sources decreased 10 percent in constant dollars, with Federal outlays declining 15 percent. In addition, the supply of scientists needed to fill positions in two of the fastest growing fields—cancer and energy research—is already inadequate and likely to get worse, concludes the report.

Each year, the board, which is the policy-making body of the National Science Foundation, presents its report to the President, who transmits it to the Congress. The focus of this year's report is the "new challenge" posed by man's increasing power to shape the future, intentionally and unintentionally, and how science and technology are providing new tools to meet that challenge.

The report reviews some of the contributions recent basic research has made toward solving practical problems. Development of the theory of continental drift, for example, has shed new light on how minerals are de-