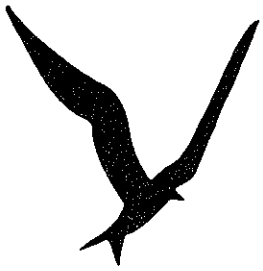


overview

In OVERVIEW books are reviewed, current events assessed, and note is taken of important developments in research and public affairs. In this department we try to give continuous coverage of developments in the many areas of interest to our readers. In addition to the regular contributions to this department, we will include occasional short reports on other topics as, month by month, they come to our attention. We would like your help in this, and urge you to submit reviews and articles of 600 to 800 words, dealing with current affairs, books, other publications, films, local community activities — or whatever you think will be of interest to our readers throughout the world. Views expressed in OVERVIEW are not necessarily those of ENVIRONMENT or of the Scientists' Institute for Public Information. S.N.

TRANSPORTATION

Radiation in Aircraft

By J. Ross Macdonald

Karl Morgan's letter-article (*Environment*, December 1972) which indicates that travelers may be exposed to an ionizing radiation dose-rate of from 10 milliroentgens (mR) per hour up to 200 to 300 mR per hour on commercial planes carrying radioactive materials seems likely to unsettle many people. Many plane trips last for three hours or more. As Morgan points out, passengers might thus readily accumulate in a single trip considerably more than the 500 mR per year dose which was set by the Federal Radiation Council as the maximum total body dose to members of the public. Further, many people (especially aircraft crew members) make numerous airplane trips per year.

A conservative viewpoint is that any radiation source that leads to even as much as a doubling of the natural background dose at sea level (approximately 100 millirem per year) should be avoided if possible. A recent report of the National Academy of Sciences Committee on the Biological Effects of Ionizing Radiations has estimated that exposure of the entire U.S. population to 170 millirem per year (the current federal standard for man-made radiation, exclusive of medical sources) would lead to a most probable figure of 6,000 extra cancer deaths per year. Thus, a possible exposure of 500mR or more in a single plane appears intolerably high and seems to call for immediate remedial measures.

There is another source of ionizing radiation in air travel much smaller than that discussed above, yet not necessarily negligible or ignorable by the above criteria. This source, galactic radiation, has been discussed, with especial regard to SST travel, by H. J. Schaefer (*Science*, 173:780, 1971). To complete the picture of radiation aloft, some comments on and conclusions from this work for both SST and ordinary jet travel may be of interest.

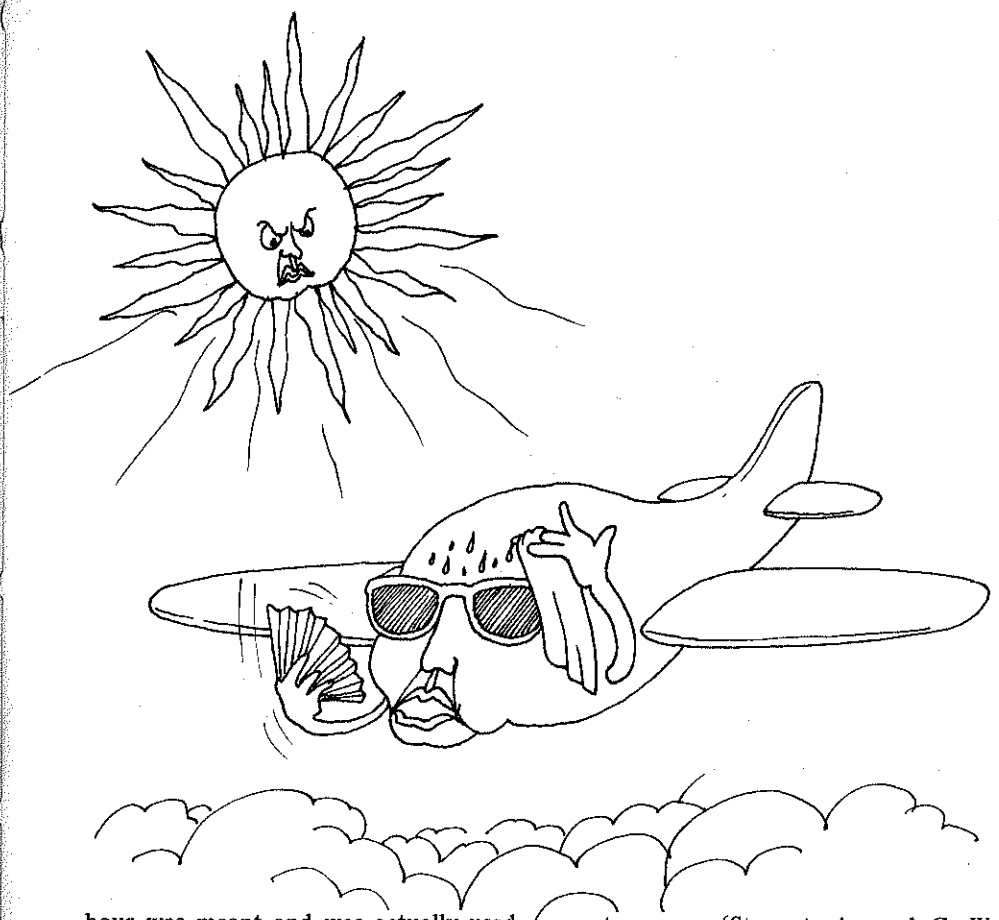
Although Schaefer states that his paper is concerned with possible harmful effects of high-altitude, supersonic-transport environmental radiation on passengers and crew, his Table I result for population dose for SST travel seems inconsistent with this aim. The problem arises from Schaefer's use of "population" in his population dose figure. He quotes a figure of 0.36 millirem per year for SST travel, calculated by dividing an estimate for the total man-rem accumulated by all commercial passengers in 1969, had they flown at SST altitudes, by the entire population of the U.S. rather than by the actual population at risk.

The above discussion suggests that Schaefer's SST calculation is an unwitting example of the following procedure:

"This practice of hiding the serious loss of life expectancy for the victims of an environmental poison by averaging the loss over the larger group of non-victims deserves strong condemnation. The sole effect of the practice is to obscure the real hazard of an environmental poison from the public . . . .

"The ridiculous nature of this approach to calculation of loss of life expectancy would be obvious to everyone if we considered an issue like the death of young Americans in Vietnam. After all, when those Americans who are at home are averaged in with those who are killed in Vietnam, the average loss of life expectancy is small, the deaths are not tragic, for, on the average, everyone is just losing days from his life. The public would not stand for such nonsense. Why they are so readily brainwashed by pseudoscientific evaluation of loss of life expectancy for environmental poisons escapes understanding." (Gofman, J.W., and A. R. Tamplin, talk presented July 20, 1971, at the Sixth Berkeley Symposium on Mathematical Statistics and Probability.)

There is an unfortunate misprint in Schaefer's article. He quotes an average radiation level at altitude during SST flight of 100 microrem (a microrem is one-millionth of a rem) per hour. But his Figure 2 and subsequent calculations make it clear that 1,000 microrem per



hour was meant and was actually used in obtaining his estimate of 0.480 rem per year for SST crew members, assumed exposed for 480 hours per year to radiation at SST altitudes. Note that the three-figure precision of this result is quite unwarranted. Schaefer believes that the 1 percent increase in risk of malignancies for crew members from such flight exposure as he calculates "is a very small increase indeed." SST crew members might not entirely agree with this assessment of their risk or with Schaefer's cavalier dismissal of their average life shortening of five days for each year of SST service. Of course, the loss of life for an individual who does develop a malignancy will generally be tremendously greater than the five-day-per-year average loss. Further, Schaefer's dose-altitude figures suggest that the radiation dose-rate may only be two or three times less on the average for ordinary jet travel than for SST travel. Thus, even present-day jet crew members seem likely to be exposed to radiation risks that many would not consider entirely negligible.

To a first approximation per mile traveled, the increased SST airspeed cancels the increased SST dose-rate compared to that at ordinary jet altitudes (see Schaefer's Figure 3). Thus, the dose received in a given trip over the same route is roughly the same whether ordinary jet or SST travel is considered. Now data from X-ray exposure of pregnant women (Stewart, A., and G. W. Kneale, *Lancet*, 1:1185-1187, June 6, 1970) indicate that the chance that an exposed fetus will develop cancer after birth is much greater if exposure occurs in the first trimester of pregnancy than if it occurs later in the pregnancy, or to a child or adult. This great sensitivity to ionizing radiation of embryos in early stages of their development suggests that to the degree that Schaefer's dose-rate data can be trusted, even a single transatlantic ordinary jet or SST round trip by a pregnant woman during this sensitive period may appreciably increase the risk of cancer to the developing child. Lederberg (*Bull. Atom. Sci.*, 28:6, June 1972) has well emphasized that radiation hazards should be examined with reference to the natural radiation background. A single such trip as that above would lead to a dose approximately equal to the natural sea-level dose accumulated in the first two months of pregnancy. Thus, such trips, and especially those which pass near the pole, where the galactic radiation level is highest, should evidently be avoided as much as possible by pregnant women, particularly those in their first trimester. □

J. ROSS MACDONALD is vice-president for research and development of a large electronics company in Dallas, Texas.

HEALTH
Air Pollution and Smoking
Theodor D. Sterling

In 1964 the Surgeon General's Advisory Committee on Smoking and Health, in its famous report, officially linked smoking to the subsequent occurrence of lung cancer and other lung disease. To those of us who had been involved in the study of the effects of air pollutants, this did not seem to matter a great deal. After all, there were no offhand reasons why lung cancer could not have many causes. However, in the enthusiasm of many of our colleagues in attacking cigarette smoking as the major public health problem, the effect of cigarette smoking has been increasingly contrasted with that of pollutants and industrial exposure until today a real question exists if cigarette smoking is not diverting attention from the effects of occupational exposure on industrial workers and of the increasing air pollution burden on the population of our communities.

The 1964 report of the Surgeon General's Advisory Committee on Smoking and Health immediately discounted air pollution as a major cause of lung cancer and chronic bronchopulmonary disease. Follow-up reports prepared by the National Clearinghouse for Smoking and Health and issued over the signature of the surgeon general have supported and expanded this position. These reports claim that, for the bulk of the population of the U.S., a large number of cancerous and noncancerous lung diseases are predominantly caused by smoking and that the effect of either air pollution or occupational exposure is minimal. Some relevant quotations are the following:

"Cigarette smoking is much more important than occupational exposures in the causation of lung cancer in the general population." And, "For the bulk of the population of the United States, the relative importance of cigarette smoking as a cause of chronic bronchopulmonary disease is much greater than atmospheric pollution or occupational exposures."[1]

Similar statements have been made in respect to chronic bronchopulmonary disease[2] and to lung cancer.[3]