Transport aircraft have improved remarkably over the past 50 years, not only in speed, safety and comfort, but also in fuel economy (passenger-mile/gallon). However, it is now clear that even greater improvements must be made in the future; the number of travelers and the length of trips are steadily increasing, and simultaneously, the world fossil energy supply is being depleted at an ever-increasing rate. This paper addresses the prospects for continued improvements in the fuel efficiency of long-range transport airplanes. The main emphasis is on subsonic airplanes, but supersonic airplanes are also discussed. Ways of improving fuel economy ranging from those possible with current technology (such as re-optimizing for minimum fuel consumption) to advanced technologies including advanced composite materials, active controls and boundary layer control. Prospects for improving engines are also described.

Since economies alone can only delay, not prevent, exhaustion of fossil fuels, alternate energy sources must also be considered. Essentially inexhaustible energy sources such as solar, geothermal and nuclear can be used to generate artificial fuels suitable for use in airplanes. Among these liquid hydrogen has perhaps the most promise. Hydrogen fueled airplanes are discussed. It is shown that hydrogen permits performance improvements, particularly for very long-range airplanes.

For very high speed HST's that will eventually supersede the SST, hydrogen is essential.