

Editorial

A simplification of a story of which all of us now are painfully aware is that we were all laughing over the assumptive errors in various studies of the economic limits of growth—in the dark. Almost without warning, from a concern that our uses of natural resources were detrimental primarily because of inadequate handling of the wastes, and secondarily from the depletion effects, the supply of finished energy resources ran out.

The suddenness of both the crises and the government's change in attitude toward sponsorship of a total energy policy and program has been breathtaking. This is not to say that there has always existed a dedicated band of both government and private groups who had been valiant, but only partially successful, in initiating such a program, nor that the proposed program is adequate, either in the short or long run.

To be sure, some of these shortages, for example nuclear-produced electrical power, are caused by the short range considerations, e.g., reactor safety, which can and must be solved by the vigorous application of technology. In the slightly longer range, say 10 to 20 years from now, the rate-limiting step will be plant capacity to process raw into finished fuel. This seems to be a problem across the entire spectrum of fuel resources, from coal gasification, to hydrogen separation, to uranium separation, which will be needed in the future for hydrogen separation. Here again, technology is the rate-limiting step both in providing economical concepts for such equipments as well as the detailed design, development, fabrication, and testing. In the long term, when we become raw-material-limited, allocation of resources with much greater emphasis on efficient utilization may become the dominant policy.

Everyone has his pet projections of the future of energy, but of importance here is their potential impact on aerospace and vice versa. It is of extreme urgency to evaluate this impact based on several possible future policies; to my knowledge this has not been done. As an example, I have listed below one possible model of the midterm future energy supply and its possible impact on transportation.

- Coal gasification will supply the majority of energy for passenger transportation.
- Hydrogen production for stationary inland thermal and electrical energy will be initiated. Hydrogen also may be utilized in transportation, for large units—e.g., ships, large aircraft, and locomotives.
- Shale oil recovery still appears unlikely.
- The breeder reactor will come into its own, possibly offshore, to generate both electrical power and hydrogen.
- Nuclear fusion is still in the research stage.
- Solar energy via satellite, which requires a new, larger shuttle, is excluded from this particular model.
- Other sources, e.g., ground-based solar energy or geothermal energy will increase but will be too small to affect transportation significantly.

Given the preceding model, the following could be the possible consequences:

- Conventional commercial aviation becomes saturated, especially short-haul. This is based on the much higher fuel consumption of aircraft as opposed to other public transportation methods. In fact, other modes of short-haul transportation

—particularly higher speed rail service—will have to become more available. But there should be a thorough examination of the energy costs to modernize the railroad roadbeds as well as of the dollar costs.

- Long-haul aviation will continue its importance, but with a shift in fuel to hydrogen, perhaps even nuclear for cargo aircraft.
- Spaceflight will continue its role of gathering, processing, and retransmitting information.
- For daily commuting, the present large automobile will virtually disappear and will be replaced by smaller units, which use less or even nonfossil fuel; and in large cities by rail commuter transportation.

There is also a possible revolution in the use of short- and long-haul passenger transportation, based on the substitution of the speaker phone for face-to-face conversations. This revolution would require the use of lasers with their economical wide bandwidth. For local distribution of such signals, fiber optics is already available. For long-range communication, the use of laser satellites is advantageous, leaving the problem of only the up- and down-link through the atmospheric weather. However, fog burn-through by high-energy pulsed lasers has been demonstrated on a laboratory scale, and conceivably could be used to overcome this last obstacle to imagery communication. High-energy lasers also may provide power transmission; for example, the launch energy of a space vehicle could be supplied by a ground-based laser operated by a nuclear-electric power converter.

It appears that the ways in which the aerospace industry, through applications of advanced technology, can contribute toward solutions to the energy shortage have not yet been taken seriously. Perhaps that is because the aerospace industry has become defensive, and has given up its roles as the major arena of adventure and the frontier of intellectual accomplishment. It appears time for us to stick our necks out.

In the past, I have sometimes given advice to authors from the viewpoint of the editors. This year, we were very fortunate to obtain advice and comments to authors from the viewpoint of a reviewer. You will find these remarks by Dr. Mark Morkovin in the November issue of *Astronautics & Aeronautics* entitled "A Harangue to Your Authors by a Weary Reviewer."

We would like to express our appreciation to our outgoing Associate Editors, whose efforts have contributed to the pre-eminence of this journal: Fred E. C. Culick (Combustion and Propulsion), Earl H. Dowell (Aeroelasticity), Stephen H. Maslen (Fluid Mechanics) and Harvey McComb (Structural Stability and Composites). We are indeed fortunate that Richard H. Battin has agreed to serve for another term in the area of Control Theory. Ruth F. Bryans and Anne Huth again are to be congratulated for solving our printing, editorial, and many other problems. Finally, our thanks to our many reviewers listed below, who are the true arbiters of our policy of quality publications.

George W. Sutton
Editor-in-Chief