Aerospace

Space transportation study

What kinds of space transportation facilities will the United States need a decade from now, between 1985 and 1995? The space shuttle will be a major component, of course, but how about smaller boosters? Or additional launching or landing sites, or specialized crew training, or different propellants? Such questions are the subject of an eight-month study now getting under way for the National Aeronautics and Space Administration at the Boeing Aerospace Co. in Seattle.

If, for example, a need is foreseen for a manned space station in geostationary orbit, the Boeing study is aimed at anticipating factors such as whether existing and presently planned rockets are up to the task, and whether the needs of other proposed programs can be economically dovetailed with those of the space station. Or, if a decision is made to dispose of nuclear wastes in space, a task for which the manned shuttle is inappropriate, how else to do it?

Boeing's analysis is being conducted in two parts. The first will involve forming a clear overview of possible program objectives, then examining their requirements in such areas as hardware utilization (getting the most use out of whatever new components must be developed), crew needs, data needs and transportation requirements. The second part will be the definition of the actual transportation equipment and systems that would be needed to make the program goals possible.

Recorder uses no moving parts

Just as in high-fidelity equipment, where loudspeakers and phono and tape cartridges are often the limiting factors in a system's performance, it is mechanical rather than electronic devices that are frequently the weak links in spacecraft design. In the magnetic tape recorders commonly used for data storage aboard spacecraft, says Charles E. Pontious of the NASA office of Aeronautics and Space Technology, failure of moving parts accounts for fully 70 percent of the malfunctions that occur.

Prompted by proposed deep-space missions that may last more than a decade, NASA has developed a solid-state data recorder with no mechanical moving parts at all. The device is based on tiny magnetic domains, called "bubbles," which exist in specially prepared garnet chips. With the aid of a magnetic film, applied in a precise pattern on the chips' surfaces, these bubbles can be controlled in such a way as to perform logic functions. In the present, experimental version of the recorder, each chip can store 60,000 bits of information. NASA's initial goal is a 100-million-bit system by 1978, with flight versions possible by 1980.

Washington U. space center

Despite the unhappy state of the economy and the uncertainties in space-program budgeting, a new center for space research is being established at Washington University in St. Louis.

The McDonnell Center for the Space Sciences is being established with the aid of $4 million in gifts from the McDonnell Aerospace Foundation, to be provided over the next four years. Beside creating a permanent base for space-science research, the funding provides for new faculty positions, a program of visiting scientists and aid for attracting select graduate students.

Washington University has been active in the space sciences for many years.

Environment

Elusive danger of small particles

The small particles of ash (less than three microns diameter) that escape through present pollution control devices may be the most toxic, concludes a team of University of Illinois scientists in the December issue of ENVIRONMENTAL SCIENCE AND TECHNOLOGY. Because of the greater relative surface area of many small particles, compared to a few large ones with the same total weight, the small ones collect much higher concentrations of toxic elements, vaporized in the high-temperature combustion zone of a furnace. The team thus found that in the stack gas from coal-fired power plants, concentrations of some 25 elements—including lead, arsenic and antimony—increased sharply with reduced particle size.

Small particles are also more hazardous because they are harder for the body's natural filter system to remove. Large particles are usually trapped in the upper respiratory system where absorption of toxins is low; but the small particles are often carried into the deep pulmonary region where toxins can easily enter the bloodstream. Small particles also remain longer in the atmosphere.

These findings may have considerable impact on future pollution control technology and regulations, for the authors conclude: "The fraction [of particles] emitted undoubtedly presents a greater potential health hazard per unit weight than that retained [by control devices]." They note that the same sort of danger may be present in other kinds of fires, such as municipal garbage incineration.

Destroying radioactive wastes

Gas-core nuclear reactors—now being developed by NASA—may find a novel and important use beyond power generation and laser pumping (SN: 10/12/74, p. 229); they may be able to clean up the radioactive waste left by other reactors. A preliminary investigation of this possibility, based on computer calculations, was presented to the November meeting of the American Nuclear Society by Karlheinz Thom, R. Paternoster, M. J. Ohanian and R. T. Schneider.

Due to its inherent low fuel mass and high neutron flux, a gas-core reactor generates less radioactive waste than conventional reactors, to begin with. But the present calculations show that the high neutron flux can also be used to dispose of long-lived radioactive wastes from other reactors by transmuting them into isotopes that either decay faster or not at all. The team concludes: "The content of wastes [would be] decreased by more than an order of magnitude in three years."

Ozone to purify water?

When the Environmental Protection Agency announced that the long-established procedure of chlorinating water might leave cancer-causing residues, a flurry of action to find out how serious the effect might be and to seek possible alternatives resulted. At the forefront was the ozone industry.

Ozone, they point out, is so highly unstable that by the time water reaches a house it has all disappeared, and no harmful residues remain. The gas is formed by passing oxygen through an electrical discharge, which transforms some of the stable O_2 molecules into a highly reactive form, O_3. "Ozonation" has been used to purify water in France for over 70 years, and Moscow plans to treat more than a third of its water in this manner by year's end.