TECHNOLOGY

NAS: The need for electronic mail

In unusually blunt language, a research panel of the National Academy of Sciences has warned the U.S. Postal Service (USPS) that the only way it can hope to save money and improve mail delivery is to adopt some form of electronic message system. Continued physical handling of mail, concludes the panel, is a "no-win situation and leads inevitably to a deterioration of services and a dependency on subsidies."

"Time is running out for the USPS," panel chairman Louis Rader told a hearing of the congressionally appointed Commission on Postal Service. "The USPS cannot meet the nation's need for a complete mail service in the future unless it adopts new strategies. The application of electronic technology to the mail service is no panacea, but it does appear to offer the USPS an opportunity to turn away from a course that shows little or no promise of improvement."

The panel estimates that electronic message service systems could replace as much as one-third of all today's letter mail, including nearly one-half the first-class mail.

A three-stage program for adopting such a system has been outlined by the panel. First would come electronic links between selected major post offices. An expanded Mailgramlike system would follow. And finally a complete, home-to-home electronic system is envisioned.

Rail may waste, not save energy

New rail rapid transit systems, like San Francisco's BART, may waste rather than save energy, according to a study reported at the annual meeting of the Transportation Research Board in January in Washington. (See also SCIENCE, Feb. 11.) University of California (Irvine) economist Charles A. Lave told engineers at the meeting: "It will even pay to shut down the existing [BART] rail system, once the congressionally mandated improvement in auto fuel efficiency becomes effective."

The fuel used per passenger mile by BART trains, he says, is now 4,610 BTUs. This consumption is less than that of today's cars, which require an average of 7,690 BTUs per passenger mile. But Congress has ordered that future cars increase their mileage efficiency to an extent that will mean an average of only 3,940 BTUs per passenger mile—less than BART. Buses, Lave says, require only 2,900 BTUs.

These figures, of course, depend on how many people are persuaded to ride the transit system, but even diverting 75 percent of all passengers away from their cars, Lave says, would mean that BART would need 193 years to "repay" the energy required to build and maintain it, in an age of more efficient cars. Still newer rail systems in Washington and Atlanta, he says, are even less efficient.

Wind energy in the 1980s

A University of California at Berkeley engineer, Marshal F. Merriam, estimates that large-scale use of wind energy "can become a reality in the 1980s." Assuming cost-effectiveness and proper siting, he writes in the January TECHNOLOGY REVIEW, even conventional propeller windmills could be producing 15 percent of present U.S. electricity use.

To many skeptics he replies, "There is certainly no problem in producing the machines; a wind generator is less complex than an aircraft. Wind surveys indicate that there are enough sites, though the certainty of this knowledge is not complete. The land requirement is not excessive, especially considering that a wind power installation will probably not conflict with other land uses. I am convinced that the prospects for wind energy are sufficient to justify a determined national effort."

SPACE SCIENCES

Earth's auroral tiara

The earth's crown of light, the band of glowing auroras that bedecks the Northern Hemisphere, seems more elegant still with a research team's calculation that the poleward edge of the band, rather than being random or distorted, forms a near-perfect circle.

It is not centered around the geographic north pole, nor even around the geomagnetic pole. More than 50 satellite photos showing auroral arcs along portions of the band's edge, however, seem to fit in a pattern that is nonetheless compellingly round. The photos, taken as part of the U.S. Air Force's Defense Meteorological Satellite Program, have been analyzed by Ching Meng and Robert H. Holzworth of the University of California at Berkeley and Syun Akasofu of the University of Alaska in Fairbanks.

Prior studies by others, based on earth-based and aircraft photography, had suggested other auroral distributions such as an oval, displaced about 3° along the midnight meridian from the dipole axis, or a pair of horseshoes, one on the day side and a larger one on the right side, according to the authors. However, they report in the Jan. 1 JOURNAL OF GEOPHYSICAL RESEARCH, the satellite photos have provided "the first opportunity to study the instantaneous distribution of auroras over a large portion of the polar regions."

Although the photos do not show the full 360° of the belt, a mathematical curve-fitting technique reported two years ago by Holzworth and Meng has been used to fit the partial arcs to closed loops. Three different statistical analyses indicate that a circle is a good fit, or at least that the ratio between major and minor axes is a nearly round 0.995 ± 0.004. The centers of the auroral circles implied by the arcs in the photos seem to be concentrated in a circular area about 6° across, centered about 4.2° away from the geomagnetic pole in the direction of a meridian defined as 0015 "dipole-magnetic local time." The radii of the circles fall in the range of about $19° \pm 5°$.

Mercury's missing spectrum

Something's missing on Mercury. Lunar maria have it, some meteorites have it, even many terrestrial rocks have it. But Mercury, according to earth-based observations by John B. Adams of the University of Washington and Thomas B. McCord, now of the University of Hawaii, does not. And the implications for the planet's early history are considerable.

What's missing is whatever characteristic of the surface would otherwise produce a 0.95-micron absorption feature in the spectrum of sunlight reflected from the planet. This feature is commonly associated with the Fe^{2+} charge-transition bands of iron, and it is missing on Mercury, the researchers report, both in spectrophotometric observations from Cerro Tololo in Chile and in infrared spectrometry from Mauna Kea.

In the case of samples from the moon, they say, the feature is lacking only in the spectra of "mature lunar soils having less than 6 percent FeO." Thus, if the lunar analogy holds, "we can conclude that much of Mercury is covered by mature, lunarlike soil containing 6 percent FeO." An eligible candidate for such a composition is anorthosite, the authors suggest, a category of minerals presumably brought up from well below the surface. This could have happened when some late- or post-accretional episode of heating melted much of the surface, allowing the anorthosites to rise to the top and the heavier iron to sink.

"These conclusions," the authors have reported to the Division for Planetary Sciences of the American Astronomical Society, "are compatible with Mariner 10 data," which show heavy cratering and a high albedo suggestive of low iron.