not know for certain why healthy and unhealthy vegetation reflect IR differently. One theory is it relates to chlorophyll; another is that water in plants is reflective and that unhealthy plant cells contain less water.)

Both ERTS satellites (A & B) will orbit at 920 kilometers in sun-synchronous orbit. They will pass over any given point every 18 days, and the sun angle at any point will always be roughly the same for each flyover.

The CARETS information will be communicated to various locations for eventual processing at a data center in Washington, D.C. Models will be constructed of the CARETS region as enough data become available. There are problems, of course. Processing the data, such as from the corn blight studies, has posed some difficult problems. And, although Interior officials will not comment, there have been rumblings that a disproportionately small amount of money is being spent on data processing and user services as contrasted with amounts for NASA's space hardware. NASA needs the hardware money; but Interior could use more than the $1.9 million budgeted for fiscal 1971 or the $5.2 million asked for 1972.

The CARETS emphasis is primarily ecological (as opposed, for instance, to geological) and the models will include inventories of vegetation, soil, water, cultural features, land use distribution, land forms and continental shelf data.

The possibilities for use of the data and model are endless. For example, the "urban heat island effect," is well-known; urban areas have higher temperatures than surrounding suburban and rural areas. The model may allow researchers to predict the exact thermal effects of a proposed new artifact, such as a freeway. Socioeconomic, demographic and other census-type data can be correlated with ecological data; the effects of a new suburban subdivision on a total urban region in terms of urban sprawl, congestion in the central city, vegetation, effect on downtown businesses and numerous other factors can be predicted with more precision.

And no longer will environmentalists have to wheedle local, state and Federal governments for a share of scarce R&D funds for studies of the kinds EROS does better. To produce an urban heat island profile of a city by other means would require thousands of ground and near-surface measurements and might be prohibitively costly. Now such a profile may become available at a small fee for anyone interested enough to go to USGS offices in Washington to get it.

The power this will give to environmentalists in their arguments before city councils, county commissions, state legislatures and Federal agencies will be immense. Says one USGS official: the data will be so indisputably objective there will be no room for debate.

CARETS and the California and Arizona studies are essentially pilot projects. If they work out—and every indication is they will—remote monitoring likely will become nationwide and worldwide. Already 20 foreign countries have asked for ERSP data. □

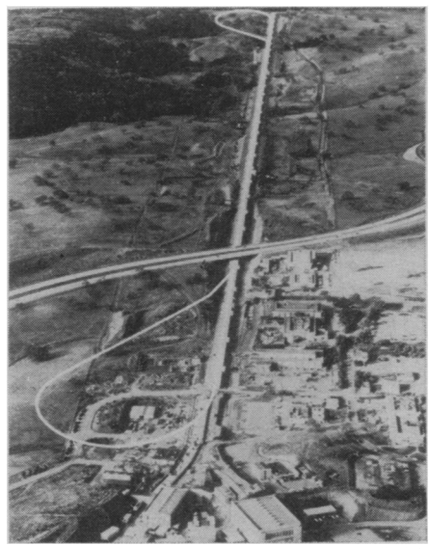
SLAC PROPOSAL

Loops in the linear

High-energy accelerators for electrons have to be built in straight lines. The reason for this is the phenomenon called synchrotron radiation. Charged particles whose direction is being changed by a magnetic field—as is always the case in circular accelerators—radiate part of the energy they receive.

Both protons and electrons are subject to this synchrotron radiation, but it affects electrons more severely because they are lighter and therefore go faster at a given energy. Above a few billion electron-volts electrons tend to radiate as much energy as they gain from a circular accelerator.

The way around the synchrotron-radiation problem is to build linear accelerators, but there is a practical limit to how big they can get. The 20-GeV machine of the Stanford Linear Accelerator Center is two miles long. To double that energy would require four miles of accelerator or running the electrons through the two miles twice. The latter is what the SLAC management now proposes to do.



SLAC

Proposed loops would double energy.

Doubling the energy in this way is one of the items in a five-year plan to start in fiscal year 1973 that the SLAC management has proposed to the Atomic Energy Commission. The installation would consist of reversing loops and drift tubes that would take the electrons from the accelerators and run them back and forth more than a hundred times until the accelerator can take them for the second acceleration. The accelerator requires 2.8 milliseconds cooling time between pulses, but the electrons traverse the two miles in about 0.025 milliseconds.

In going around the loops, the electrons would be subject to synchrotron radiation. The plan includes a booster section to give back the lost energy. Superconducting waveguides may be used for the radio frequency waves that accelerate the particles in this section if superconducting technology is deemed reliable enough when construction starts. If not, says a SLAC representative, there are other more conventional options at the same cost.

The drift tubes can be laid in the existing tunnel alongside the present accelerator, obviating any need for new tunneling. The total cost of the new work is estimated at $16 million. The existing SLAC cost $114 million.

Already planned improvements to the existing accelerator will raise its energy to 25 GeV so the double run would actually produce electrons around 50 GeV. There is no possibility of going to multiple runs, because the synchrotron-radiation loss in the loops would become prohibitive at higher energies.

Physicists would like to have the 50-GeV electrons so they can further explore promising lines of work opened by the existing accelerator, especially the study of partons. Two years ago SLAC physicists announced that experiments had shown that the proton is composed of discrete subparticles; they called them partons. Electrons—and the particles that can be made by striking electrons on targets, gamma rays and various mesons—are very useful in probing the structure of larger particles. Higher energy electron probes may help discover the nature of the partons and how they are put together to form protons and neutrons.

The reversing loops could also possibly be used to provide colliding-beam experiments between two beams of 20-GeV electrons, suggests Dr. S. S. Brodsky of SLAC.

The proposal is submitted at this time because the AEC is beginning work on its budget for 1973, in which, the SLAC people hope, the first funds will be included. AEC professionals tend to favor the idea; but no one is guessing whether it can be sold to others who have a say about the budget. As one AEC physicist put it: "What goes in at the beginning of the budget cycle doesn't always come out the other end." □