predistorted laser beam is created from the pilot and reference beams. This fourth beam contains the conjugate of the distortions in the actual light path.

While the device is still in the laboratory stage and a long way from practical use, several applications are possible. For example, says Liao, the precisely aligned optical elements, such as lenses or prisms, that guide light in high-powered fusion research lasers tend to deform under the influence of heat generated by the beams. This distortion obviously reduces accuracy in directing the light.

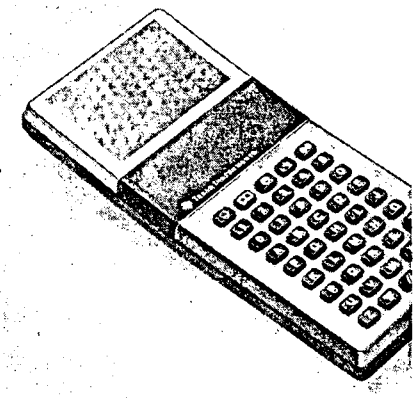
Fire away. Up to now, the solution has been to limit the firing rate of the lasers. But this in turn limits the power generated. With the new predistortion technique it may be possible to precompensate the light and fire the lasers more often, researchers believe.

Further work at Bell, Liao says, will concentrate on optimization of the process and applying it to spectroscopy problems—in the area of properties of materials, for example. Others investigating these conjugate waves include Robert Fisher and Barry J. Feldman of the Los Alamos Scientific Laboratory's Carbon Dioxide Laser Technology group, Los Alamos, N. M. They hope to solve system alignment and amplification problems in the lab's laser fusion work. **-Harvey J. Hindin**

Consumer

Hand-held translator speaks out loud

Ever looked up a foreign-language phrase in an overseas restaurant, pronounced it, and got only a quizzical look from the waiter? Realizing that mere sympathy won't fill your plate, engineers at Texas Instruments Inc. have developed a hand-held unit that not only translates and displays foreign words and phrases, like other translators, but speaks them in the foreign tongue, too.



Fluent. Talking language translator, shown here in prototype without display, is calculator-sized and powered by four AA batteries.

TI's language translator is the third to reach the market, following recent products introduced by Lexicon Corp. [*Electronics*, Dec. 7, 1978, p. 50] and Craig Corp. [*Electronics*, Dec. 21, 1978, p. 34]. It is, however, the first to talk, a feature made possible by TI's single-chip speech synthesizer [*Electronics*, Aug. 31, 1978, p. 109]. This is the same chip that is the heart of the company's popular Speak & Spell learning aid for children.

Six chips. Besides the speech-synthesis chip, which has been modified to improve its diction, the talking translator contains a TMS 1000 controller and four 128-kilobit low-speed read-only memory chips. Plug-in ROM modules give the translator a 1,000-word vocabulary. Of the 1,000 words, 500 can be displayed and pronounced; the rest are displayed only.

The translator, to be unveiled next month at the 1979 International summer Consumer Electronics Show in Chicago, will retail at $250; shipments of English and Spanish versions will begin in September. The French, German, Japanese, and Chinese modules, priced at $50 each, will be available by the first quarter of 1980.

Other manufacturers have brought out talking consumer products like chess-playing computers, but they all use expensive multichip speech synthesizers. For this reason, TI has been flooded with requests for its chip. But it isn't selling—yet.

"We're busy enough making ICs for Speak & Spell, which we're now producing at the rate of 40,000 to 60,000 a month," reports Doug Lindgren, manager of the company's Consumer Specialty Products division in Lubbock, Texas. Should it reduce its backlog (or if National Semiconductor Corp., which is rumored to be working on a single-chip speech synthesizer, puts one on the market), that policy may change very quickly. **-John Javetski**

Medical

An rf solution to a beef cancer

Cattle have better access to some forms of cancer therapy than human beings, particularly radio-frequency hyperthermia. While rf hyperthermia is still an experimental technique for human cancer patients [*Electronics*, April 26, p. 88], it's at home on the range today.

"Eventually, there may be more cowboys treating cancer than M. D.s," says James D. Doss, staff member of the Los Alamos (New Mexico) Scientific Laboratory. The reason is what is called cancer eye, a common affliction of the nation's beef herds.

The problem is an important one. From 12% to 17% of breeding stock in the Southwest may be afflicted with cancer eye—the leading cause of cattle carcass contamination in 1975, according to the Department of Agriculture. The disease, if untreated, is about 80% fatal; it starts in an eye socket and may quickly spread to tissue in the head and nervous system. Losses due to cancer eye may cost ranchers more than $20 million yearly—and may cost consumers even more, if the effect of these losses on the retail beef market is considered.

The treatments available have been about the same, and about as costly, as those for humans. So cancer eye has usually gone untreated. But now there is a fast, simple, and inexpensive treatment available that promises to cut these

Hand-held cancer killer. Interior of prototype rf hyperthermia applicator shows miniature 2-megahertz oscillator and temperature-control circuitry. Unit can help manage up to 90% of cattle cancer-eye cases.

stock losses dramatically.

Doss's development, funded by the Department of Energy, grew out of a cooperative program with the University of New Mexico Medical School, Albuquerque—where Doss is a clinical associate—on rf hyperthermic treatment of animal and human tumors. When the results—significant regression of many tumors—were discussed with veterinary authorities, they pointed to the cancer eye problem, and Doss and his collegues went back to the lab in search of a solution.

Dashboard unit. About two years of work resulted in a system that, in some forms, is powered from the 12-volt cigar lighter socket on a pickup truck dashboard. Very like a pistol grip in appearance, the unit has two small protrusions extending above the trigger site. One is a miniature rf emitter; the other is a temperature-measuring thermistor.

Inside the hand-held unit is a miniature 2-megahertz oscillator. Also included is temperature control circuitry (see photo).

The animal is given a local anesthetic and the probe pressed against the tumor. Operating at about 2 megahertz, with up to 10 watts of power available, the device heats the tumor fast.

In seconds it brings the cancer up to the 50°C needed to attack it; the user then keeps the probe tips in firm contact for about 30 seconds. With the exception of an antibacterial spray, or some eye drops, that is the extent of the treatment.

Doss selected 50°C (about 122°F) because cancerous bovine tissue is damaged at such temperatures while normal tissue is well enough cooled by its blood supply to survive without injury. But to avoid excess heating, the thermistor closes a control loop that varies rf output to keep temperature constant at 50°C, according to the researcher.

Results. Remission occurs within a few weeks, typically two to four weeks. Cure rates in pilot studies by the Los Alamos laboratory were as high as 90%—an unheard of cancer remission rate, for animals or human beings.

As a result, there are now about half a dozen companies offering or about to announce commercial versions of the system, Doss says. Among the two largest are the Agricultural division of the Hach Chemical Co., Ames, Iowa, and MDR Inc., Phoenix, Ariz. There is even a unit from relatively small Apache Indian Enterprises, Inc., Dulce, N. M. Prices run between $400 and $600, and according to a Hach Co. spokesman, "are selling very well for new introductions to a traditionally conservative market." **-James B. Brinton**

Careers

EEs got 11.6% raises, AEA survey reveals, but some regions are boosting pay higher

If you are a nonsupervisory engineer with a bachelor's degree and did not get at least an 11% raise in the past year, you slipped behind the industry average, according to a recent nationwide salary survey covering 45,410 engineers.

The canvass by the American Electronics Association shows that combined salaries nationwide in that category rose 8.99%, while raises averaged an 11.56% gain. The difference between the two figures occurs because the first relates to all engineers from entry level to 24 years past their degree, whereas the second omits those at entry level. In terms of monthly salary, the average engineer nationwide earned $1,506 the 2nd year after receiving a bachelor's degree, $1,722 the 5th year, $2,026 the 10th, and $2,431 the 20th.

Of course, averages can be misleading, and significant regional differences must be taken into account. In the Pacific Northwest, for example, combined salaries rose 15.44% and raises increased 18.05%, but the monthly income figures were in the average range. AEA officials surmise that these figures reflect the tremendous expansion and additional hiring by electronics companies there. The survey, which covered 576 big and small electronics companies in eight categories—supervisory and nonsupervisory with either bachelor's, master's, doctoral, or no degrees—reveal these trends among nonsupervisory and supervisory bachelor degree holders by region:

- California. As might be expected, the San Francisco area had above-average increases, 9.52% overall and 12.04% in raises, but those for the whole state, with the Los Angeles and San Diego areas, were about average.
- Colorado. This region experienced only a 3.08% general salary rise and a 4.9% average raise. Furthermore, nonsupervisory engineers made slightly less than average. The super-