Push-to-Think:

COMPUTERS FOR PILOTS

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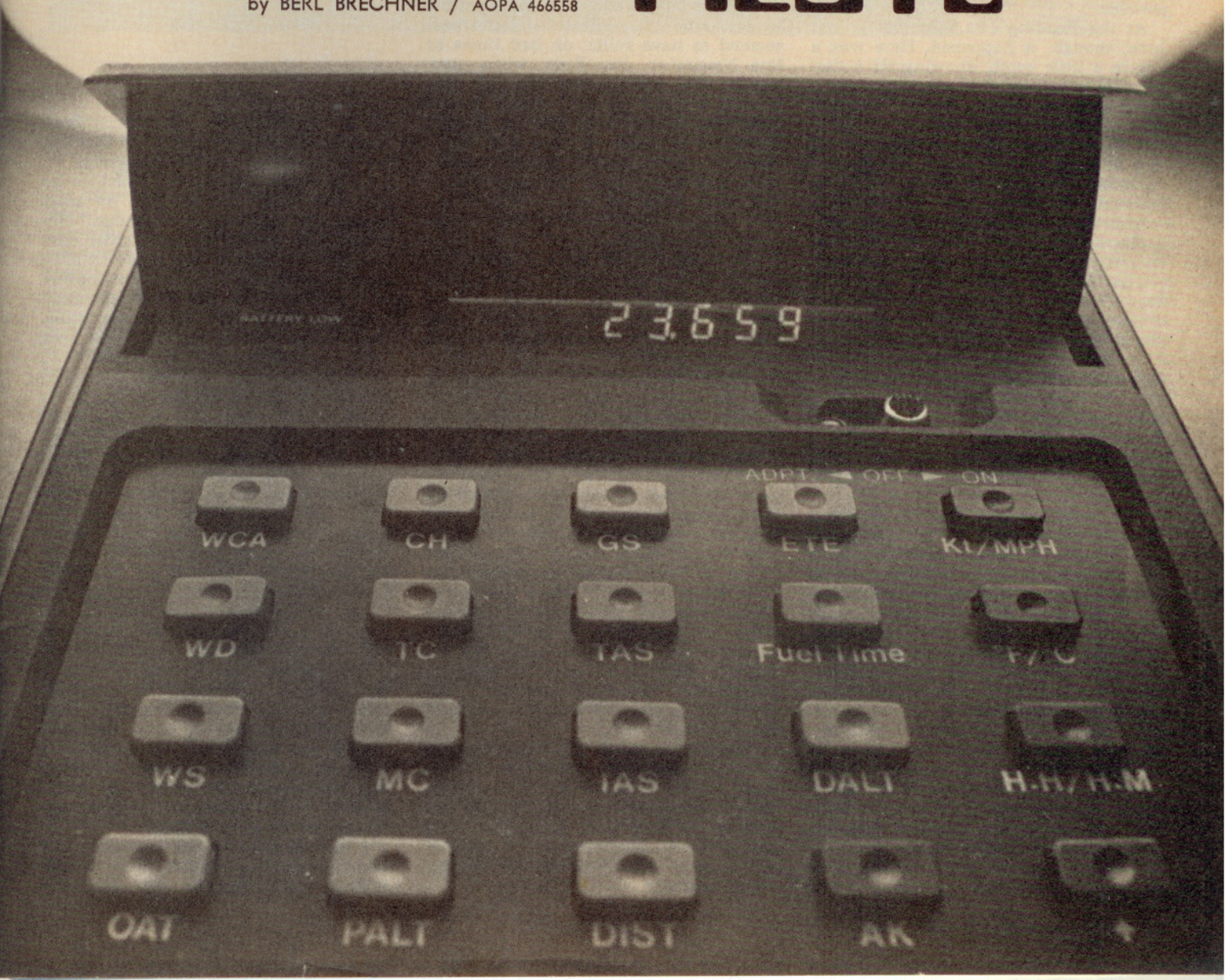

The electronic revolution is finding its way into flight planning, and the new year might see the beginning of the end for the old E6B

■■ Not long ago I had my first exposure to one of those pocket-sized computers that tally your grocery bill or multiply two weeks' pay times 26 to tell you how little or how much you'll earn during the coming year.

It was fun to play with and, since I'm kind of slow with numbers, it seemed to make checkbook balancing a lot more pleasant. But I still wasn't ready to shell out $79.95 for one, because checkbook balancing might then have become impossible.

At the Reading (Pa.) Air Show last June, though, it happened. Here was a guy in a little booth, showing off a tiny portable computer that would do everything with numbers a general aviation pilot might ever dream of.

Sure, it added, subtracted, and did all that fifth-grade stuff. But it also opened up a new world of electronic digits by replacing an old standby, the WW-II version of the E6B flight computer, with a plastic box full of batteries, pushbuttons, circuits, and twinkling numbers.

The E6B, of course, was near and dear. That's what my first instructor had taught me how to use; that's what had gotten me successfully through three FAA written exams; and that's what helped assure a flight from Point A to Point B without an unplanned landing at intermediate Point C due to lack of fuel.

As attached as I was to the E6B, I still marvel (as do most pilots) at gadgets. I was very curious.

The Reading booth with the man and his marvel swarmed with other pilots as curious as I. He was drawing crowds like the medicine man passing through Dodge City. Not one of those pilots eyeing the electrical contrivance really needed it, for most had flown in to Reading quite handily without one. But it was automatic and had flashing lights, and the onlookers were fliers. That alone should explain the crowd.

It turned out that the gentleman represented Summit International Corp., of Salt Lake City, and the computer at the show was only a prototype. It did all the things it was supposed to, such as figuring true airspeeds, density altitudes, wind triangles, ground speeds, fuel consumptions, and so forth. But it was somewhat less than portable, being wired to a foot-square black box hidden under the counter. Also, it was not available for sale to the public.

Gary Lunberg, the device's demonstrator (who is no longer with the company), said the computer would be available soon, at a price around $350. He didn't say, however, that Bede Aircraft was supposed to market the computer, and the booth he was in (next door to the BD aircraft display) was being paid for by Mr. Bede.

Well, to keep a long story from getting longer, the Summit-Bede agreement seemed to have fallen on bad times by late November. Jim Bede, when questioned, said the product was due that month, but was already a year behind schedule. At that point he was looking elsewhere because the company "didn't come up with results." A Summit spokesman indicated that the project had "too many bugs not ironed out yet," and later added that the computer venture "might be scrapped."

Even so, interest among pilots had been proven high. Summit said the device's sole exposure at the Reading show brought 10,000 inquiries from pilots who filled out a short questionnaire on their computer needs.

About the time Bede was realizing that the electric computer market might present some postpartum problems, several other companies plugged their calculators into the aviation circuit.

Hewlett-Packard, a California company that had already built one of the fanciest hand-held models available, began marketing an "Aviation Pac" to go with its HP-65 computer. This model, priced at $795, ingests paper-thin magnetic programs and, when the proper sequence of buttons is pushed, spits out more numbers than a normal person would know what to do with. HP was making available 29 of these magnetic slivers for aviation—programs that would make the E6B look like aviation's nursery school toy.

Another company, the Systek Corp. of Tokyo, Japan, introduced (but as of early December had not yet marketed) their Navcom-1 computer. It, too, handles all the E6B stuff, plus a few other things—and, according to a company spokesman, will do it for under $400 when available.

Then in December a fourth company, Specialized Electronics, Inc., of Chicago, ran an ad in an aviation magazine for the Navtronic 14. It was billed as an electronic E6B that would "fly rings around that old-fashioned slip-disc." Unfortunately, the C.O.D. mail order offer at a special introductory price of $189 proved premature; a company vice president recently told The PILOT the computer won't be available until late spring. Checks sent for the computer have been returned, said the official, Ron Katz.

A fifth firm also proposed to produce a pocket computer for pilots, but theirs was to be more than an E6B. An internal timer would act as a "poor man's DME," and also as a countdown timer. Pacer Systems, of Arlington Va., made preliminary plans to build the Pacer 2400. But most recently the company was hedging on its scheme, as questions concerning "company priorities" were coming into play. If they did go ahead with it, said an executive with the firm, the Pacer model would come out in mid-1975, priced in the $350 to $450 range.

Of the five pilot computers envisioned by the various manufacturers, two have been presented publicly: Systek's Navcom-1 and the Hewlett-Packard HP-65 with Aviation Pac. Of those two, only the HP was available for purchase as of early December. Systek's officials at their U.S. headquarters in Carson City, Calif., were actively considering various marketing options at that time.

The two products are a world apart, both in price and capabilities. Hewlett-Packard's HP-65 is, in fact, totally dif-

Hewlett-Packard's HP-65, left, will perform an unending variety of computations, while the Systek Corp.'s Navcom-1, right, is more of an electronic E6B.

ferent from any of its four counterparts. It is so different, indeed, that representatives of the other four companies in the business did not even consider the HP product as competition with their own.

Briefly, the HP-65 is a pocket computer with an incredible array of mathematical, statistical, and computational capabilities. It has 51 keyboard functions, can zip through prerecorded magnetic programs of up to a hundred calculations in seconds, and can be programmed by the user to do just about any series of equations he or she can dream up. Homemade programs can then be "written" on your own magnetic cards, and saved for use along with those provided by the company.

Let me admit my failings. I am not much of a mathematician, having squeaked through high school trig, plane and solid geometry, and a couple of years of algebra—but barely. College led to two very unhappy semesters of math with business applications.

So my first exposure to an HP-65 brought out a lot of long-repressed hostility toward mathematics. For when I viewed its face I saw long lost hieroglyphics all over it, like: $x > y$ and π and y^x and $\sqrt{x}$ and $n!$ and $x \neq y$, and so forth.

Then I was confronted with the unit's array of instruction manuals: a 107-page Owner's Handbook; a 32-page Quick Reference Guide; a 78-page instruction book for the 19 standard programs supplied with the HP-65; and a 118-page manual explaining the Aviation Pac programs. The total package—computer, two sets of programs, manuals, AC cord, leather case—is priced at $840.

And it's worth every penny of the cost, provided you have uses for the machine other than aviation. Utilizing the computer only for its pilotage programs would be an affront to its intelligence, since you'd probably be taking advantage of only about 5% of its vast capabilities. Even as a general aviation aid, it produces an overwhelming amount of highly peripheral, once-in-a-lifetime information.

For instance, do you really need to know your estimated time enroute down to the second? Is the diameter, in nautical miles, of a 360-degree turn, using a 57-degree bank angle, important to know? Do you often plot your courses along great-circle routes? Is the true heading of the sun as it rises or sets critical flight information? Have you recently had the need to know the true air temperature and density altitude, corrected for the compressibility effects of high-Mach airspeeds?

If you answer yes to some of these questions, and if you can employ any of the HP-65's other talents (medical, navigation, finance, statistics, math, engineering, and surveying program pacs are also available), then this enthralling electrical invention might be for you.

Using the HP computer is not as difficult as it might appear. Spend a quiet Sunday with the machine, programs, and instruction books, and you'll probably have a pretty good working knowledge of the device by Monday—at least as far as basic aviation calculations are concerned.

Still, it will take you a lot longer to develop an adeptness that will allow confidence in your answers. There are a good many procedures to learn and a number of buttons to push. For instance, once the "Flight Plan with Wind" program is in the machine, a four-leg trip requires the pushing of 27 function buttons, in addition to the dozens of numerical and decimal-point buttons it takes to key in the variables (like TAS, course, fuel consumption rate, wind headings and directions). A sample problem in the instructions requires 67 strokes of the index finger to complete the planning of a four-leg trip.

Such a program is one of the more tedious aviation functions, and most of the others require less button-pushing.

Probably the biggest drawback in actual use of the machine comes in digging through the plastic program storage pac (2 inches by 3 inches by ¼ inch deep) to select the proper program from the 40 program cards inside (11 are blanks). Each of the 29 magnetic aviation programs is 2¾ inches long, and paper-thin. The identifying title is in lettering about 1/16-inch high. The cards are hard to handle, and a program dropped between seats can be considered gone for the rest of your flight.

Adding to this difficulty is the necessity, on some occasions, to use more than one program card to come up with your answers. For instance, the density

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altitude program calls for insertion of temperature in degrees Celsius. If you are only provided with degrees Fahrenheit, you would first (assuming you didn't know the conversion formula in your head) have to insert the "pilot unit conversions" program, which has a Fahrenheit-to-Celsius function, and then insert the density altitude program for use with your newly found Celsius temperature.

Suffice it to say that preflight planning of programs to be used—and having them accessible in flight—relieves your eyes and hands of a lot of work time that might better be devoted to looking and flying.

Be aware, too, that you are dealing with a computer, not a real airplane. A rate of climb and descent program for the HP-65 will give you textbook numbers but will not correct for decreased aircraft performance as altitude increases, or for a pilot's variations in climb airspeed.

A final problem is the size of the digital readout on the unit. Because of the scientific nature of the instrument, it has spaces for 15 characters across its 2½-inch-wide front. Thus, each of the red digits measures just a bit over ⅛-inch high. Numbers are small and hard to read in bright light, and invisible in direct sunlight.

Systek Corp.'s Navcom-1 is designed completely differently. It is intended only for aviation use (but also allows all basic math computations) and comes preprogrammed in one unit. Switch it on and it's ready to calculate.

The Navcom-1 is remarkably nonscientific and has basic instructions that simply tell you which buttons to push, in what order, for a specific function. The unit will store about 14 variables, and permits you to change any one of them and then recompute the answers.

Instructions for the Navcom-1 are contained in one 18-page manual, and half its pages are in Japanese. If your navigation and flight-planning capabilities are up to snuff, about two hours' worth of initial exposure to the computer and its instructions should be enough time to obtain a good working knowledge of the mechanism.

Once you're proficient with the Japanese computer, flight planning—including wind corrections, enroute times, and ground speeds—can be computed in a minute or two. Still, there are a good number of buttons to push. The problem that took 67 finger strokes on the HP-65 requires 94 on the Systek computer. In both cases, many steps are repetitive and learned quite quickly. Given the same inputs, both machines computed matching answers.

A flip-top sunshade on the Systek device shields the digital display's blue, ½-inch-high numbers. The sunshade permits good readability, but direct sunlight on the display poses a problem.

Prerecorded aviation programs, 29 of them, are optionally available with the HP-65.

When the machine is provided with accurate navigation and wind information, it will compute an ETA down to the minute, provide fuel consumption information, handle all your time/speed/distance problems, give density altitudes, and allow a quick check of winds and ground speeds on your route.

Three buttons on the computer provide instantaneous conversions from nautical to statute miles, from Farenheit to Celsius, and from hours : hundredths of an hour to hours : minutes. Pushing one additional button provides these conversions in reverse.

As with all pocket calculators, turning the machine off erases its various memories. So when it's time for a new problem, the variables (speeds, winds, course, variation, altitude, etc.) must be reinserted. Only if you leave the unit on at all times during a particular flight will it hold onto the information you've initially given it.

The Navcom-1's rechargeable batteries last about two hours with continuous use; the HP-65 is rated for three hours' use. A cigarette lighter plug, however, is supplied with the Japanese computer. Both can be plugged into a wall socket.

A further limitation on the Navcom-1 is that its program for conversion of true airspeed to indicated airspeed is applicable only below 15,000 feet and 150 mph. The 15,000-foot limitation holds true, also, for density altitude calculations. The HP-65 has few, if any, limitations that would apply to general aviation flight.

A word of warning. Electronic calculators, when close to ADF antennas, reportedly emit radio noise that can interfere with the proper sensing of the ADF needle. Hewlett-Packard says as long as its unit is at least five feet from an ADF loop antenna, there will be no problems. If your calculator does interfere with a navigation instrument, you may be in violation of FAR 91.19, which limits use in the cockpit of any portable electronic device creating navigation or communication problems.

A couple of companies are hoping to make a bundle by being first to put out a low-cost pocket computer for pilots. But they're finding that it costs a bundle to do it—at least to do it right. Problems with money, patents, and designing and obtaining "chips" (the subminiature printed circuits that constitute the computer's brain) have all played a role in tripping up, or at least temporarily blocking, the proliferation of aviation computers.

But it appears that by the end of 1975 several will be available at prices from $200 on up towards $900—with as wide a spread of capabilities. Your old smudgy E6B can be replaced these days for $15 or so, and whether it's worth 20 times that price to see digits glimmer out answers to questions you probably didn't really need to ask—well, that's up to you. But pilots are indefatigable lovers of gadgets, and aviation computers are among the newest—and most intriguing. □