The Standard Telephone cable also will be a windfall for its parent, ITT, because **the electronics work, about half the total of $92 million to be spent, will be split among fellow British ITT subsidiaries.** The 1.47-in. cable, when completed on Columbus Day 1977, will handle 1,840 phone conversations plus data and teletypewriter traffic along its 1,840-mile route.

Honeywell wins Army copter altimeter award

Despite grumbling from some would-be late entries, the Army Electronics Command at Fort Monmouth, N.J., plans to award a sole-source contract **for an "absolute" radar altimeter for Army helicopters to Honeywell Inc.** Honeywell beat out Hoffman Electronics Corp. in a fly-off competition that began in January [*Electronics*, Dec. 26, 1974, p. 20] with prototype tests.

The Army wants accuracy within 3 feet ±3% of altitude from zero to 250 and ±5% from 251 to 2,500 ft. The system is expected to be sensitive enough to display the altitude from the tops of trees, snow, and ice, or the ground if there is no cover. The key to the contract is that Honeywell must build each altimeter for $3,500 or less to fill an initial order of 2,000 units. Radar altimeters that do the job now cost about $7,300.

$100 8-bit a-d converter due from Motorola

A three-chip, 8-bit analog-to-digital converter that will sell for less than $100 in quantities of 100 is the target of Motorola's Semiconductor Products division in Phoenix. The firm plans to spec the system for a minimum 15-megahertz sampling rate, aiming at "smart" instruments, such as fast Fourier transform devices and digital scopes, and military and commercial radar systems. **Builders of those systems now pay more than $1,000 for pluggable a-d subassemblies, hybrids, and discretes potted together in a module.**

Motorola sales drop in 2nd quarter

Motorola Inc.'s sales in the second quarter declined to $345 million from $365 million in the same period last year, reflecting continuing unprofitable operation at the Semiconductor Products and Automotive Products divisions. **And it's at least the third losing quarter in a row for the semiconductor operation,** where management changes continue. The latest is the appointment of Robert W. Heikes as assistant general manager, the spot occupied by John R. Welty before he was made general manager. Heikes has been the division's manager of European operations.

Addenda

The FCC says it will permit multiple licensing of community repeaters, which are essentially shared base station transmitters, in the development of land-mobile cellular systems at 900 MHz. The FCC clarification of the point, raised in Federal court in June, **is expected to make it easier to develop systems competitive with AT&T's.** . . . Collins Radio has won the $14.6 million Air Force contract for an initial 1,000 Tacan (tactical air navigation) sets, **with an option for 7,000 more.**

Microprocessor line offers 4, 8, 16 bits

MOS Technology's low-cost n-channel family is compatible with Motorola's 6800; provides 68 instructions and 11 addressing modes

by Laurence Altman, Solid State Editor

Being an alternate source to as well-accepted a microprocessor system as Motorola's 6800 isn't bad for a medium-sized company like MOS Technology Inc., which until recently had only a p-channel process—suitable primarily for calculator chip design. But being able to supply the microprocessor system in an advanced n-channel design that offers the user additional benefits at a lower cost is even better.

That's what MOS Technology has done with its first entry into the microprocessor field. In fact, the Pennsylvania-based company has introduced four software-compatible versions of its microprocessor family that promise to outperform similar products already on the market—and to do it at a lower cost.

The family's first entry is the MCS6501, an n-channel, silicon-gate, depletion-load device that operates from a single 5-volt supply. A plug-in replacement for the Motorola 6800, it will be offered for delivery in September for an incredibly low single-unit price of $20. Future software-compatible versions will range from low-cost 4-bit systems to high-performance 16-bit products.

The Motorola 6800 chip served as the point of departure for MOS Technology's design because Chuck Peddle, marketing director for microcomputers, felt it could be upgraded most directly "using our smaller-chip capability." The chip, however, has been reconstructed to include some key user-oriented features. Among these improvements are significant expansion of addressing capability, including two real index registers (not available on any other single-chip device), two powerful forms of indirect addressing, an 8080-type READY, fast decimal arithmetic (including subtract), and pipelining for higher throughput.

For example, the 6501 lets a user load, add, and store in three locations in 9 microseconds. In another benchmark operation, the 6501 can move an n-length word from one memory location to another in only 13 microseconds, compared to about 20 μs for the Motorola and 23 μs for the Intel devices.

None of these benefits, however, will complicate the use of the 6501 by the growing number of people familiar with the 6800 system. The chip is plug-compatible with the 6800, runs from the same single 5-V clock, comes in the same 40-pin package, uses the same 1-MHz Motorola two-phase clocking, and can play with any of the Motorola peripheral or communications-adapter interface chips. In addition, MOS Technology will supply some unique peripheral circuitry, including RAMs and ROMs.

It should be pointed out, however, that the 6501, while plug-compatible with the 6800, is not truly bit-compatible, but requires some recompiling of the standard 6800 instructions. Yet the family will be fully supported by an advanced cross assembler—the only "Fortran-like" emulator available in the industry—and a full range of easy-to-apply documentation. Starter sets to be offered by the company range from a two-chip $50 set to an advanced sophisticated microprocessor-development terminal.

Another version of the design is a still easier-to-use 8-bit 6502 chip. This device requires only a single-phase TTL clock, instead of the Motorola two-phase clock. Or, simpler yet, it can be latched for an RC network to generate its own clock. The unit price is $25.

For 4-bit systems, a low-cost small-packaged version is also being offered. This 28-pin single-phase design, which is limited to 4-kilobit address capability, is intended to serve as a low-cost replacement product for 4040-based systems.

Rounding out MOS Technology's immediate microprocessor efforts are two more chips now in design. They are a Fairchild-like F-8 equivalent that contains the I/O on the chip and a design that Peddle calls a pseudo 16. Upward-software-compatible with the others, it's capable of 8-bit transfers and 16-bit operands.

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What's on the chip

With its advanced n-channel process, MOS Technology Inc. has packed a great deal of computational power on the basic microprocessor chip. This includes a high-speed accumulator, the arithmetic-and-logic unit, a program counter, an instruction register, instruction decoder and control circuits, two index registers, and all input and output buffers needed to operate with the Motorola 8-bit bus system. The chip architecture differs from that of the 6800 in that it has one accumulator and two index registers, while Motorola's has two accumulators and no index register.