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FEBRUARY 1983 Vol. 54 No. 2

ON THE COVER

Once considered a dream, the computer-controlled airplane has become a reality, with the introduction of the Boeing 757/767 aircraft into commercial service. This month, we'll take you into the cockpit of that fascinating airplane, and show you the systems and features that help make it one of the most sophisticated in the sky.

You don't always need a long antenna to get good VLF reception. The active antennas shown here are just one meter long but often outperform ones many times their length. Find out more about active antennas, beginning on page 63.

If you are one of those that love to spend hours at a time with your home videogames, your hands are probably taking a beating. Give them and yourself a break, and build this controller for your Atari VCS system. The story starts on page 42.

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VIDEOGAMES

What's new in home videogames

DANNY GOODMAN, CONTRIBUTING EDITOR

THIS YEAR HAS SEEN THE INTRODUCTION of a confusing array of new home-videogame systems, as well as enhancements for existing systems, calculated to attract literally millions of new players to the home-videogame market. If you are one of those facing the potentially emotional decision of which system to buy, this new monthly column will be just what you're looking for. In this first one, we will look at some of the things to consider as you twiddle the controllers at the video counter.

Hardware

Game players today demand more realism from their systems. For sports and similar games that means the ability to input more strategy as well as realistic character, playing-field, and action graphics. In arcade-type games, players demand graphics that approach the color and detail of the high-resolution coin-operated units. While the home color-TV receiver cannot match the resolution of an arcade monitor, a home TV does an admirable graphics job with systems like Coleco's (200 Fifth Ave., New York, NY 10010) *Colecovision*, Video Technology's (68 Sung Wong Toi Road, Tokwawan, Kowloon, Hong Kong) *Creativision* (which was scheduled for December 1982 introduction), Arcadia's (324 Martin Ave., Santa Clara, CA 95050) *Supercharger* for the Atari (1265 Borregas Ave., Sunnyvale, CA 94086) *VCS*, and Atari's *5200* deluxe system. By way of comparison, the *5200* has the same graphics resolution as Atari's *400/800* home-computer systems.

One system that can produce true arcade-type graphics is the cartridge-programmable *Vectrex* vector-scanning home-game from General Consumer Electronics (233 Wilshire Blvd., Santa Monica, CA 90401). That is the only home system, at least until now, capable or reproducing the outline-formed characters used in such arcade games as *Asteroids* and *Tempest*. To accomplish that feat, the game uses its own vector-scanning video monitor (more on the *Vectrex* system next month).

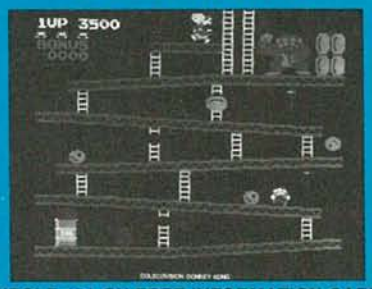
The newer systems all use all-in-one hand controllers. As the *Intellivision* controllers proved, a keypad used in conjunction with a joystick or direction-control disk, is an effective way of communicating with the game computer. The Atari *5200* also allows you to vary speed using the joystick; for instance, the faster you push the joystick to the right the faster your screen character moves to the right and so on. The effect here is similar to using an arcade-style track ball (such as those found in games like *Centipede* or *Missile Command*).

All manufacturers now realize that the success of their systems depends largely on the amount of games available for it. And if there is one undisputable fact about home-videogames, it is that there is more support for the Atari *VCS* than any other system (and perhaps more than for all of them combined!). The reason is simple: game-cartridge developers have many millions more hungry *VCS*-users to satisfy than users of any other home system. But that large existing library can prove to be a considerable obstacle to any new system that is introduced. After all, few buyers would be willing to invest in a new system with little support, considering what else is on the market. What Coleco has done to offset that problem is come out with a system adapter that will allow their *Colecovision* system to use Atari *VCS* cartridges, and Atari is planning to introduce a similar adapter for their own *5200* system sometime this year.

The introduction of those adapters makes sense for many reasons. First of all, any new system will have only a modest offering of its own games at the outset—one company can do only so much in a limited time. With adapters, the unit is immediately usable with an already existing library of cartridges. Next, for the game owner wanting to upgrade to a more advanced system, a substantial investment in game cartridges (usually much more than the actual cost of the console) won't be wasted when switching to a new unit. If all home game-consoles featured adapters for most other systems, the consoles could compete solely on the basis of features such as controllers, computer add-ons, creative graphics, sound effects, and the like.

There is also suddenly an interest in serving what is known as the videogame hardware aftermarket—otherwise known as add-ons for your videogame. Electronic speech modules (*Intellivision, Odyssey 2*, and Atari *5200*) and hand controllers of all kinds (mostly for the *VCS*) are already joining game organizer-type cases and cartridge racks on your dealer's shelves. Many of the newer systems provide expansion connectors for future add-ons. As with computers, expandablity means that a system will be able to grow with you, as well as with changing technology.

Coleco's Donkey Kong for Colecovision



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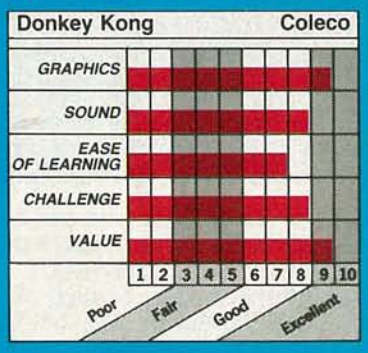


Coleco's *Colecovision* comes packaged with the home version of the most popular non-combat arcade game since *Pac-Man*: *Donkey Kong*. The game looks simple—move your mustached character, named Mario, up various girders and ladders to rescue a "fair damsel" who has been abducted by the fierce Kong. But successful execution requires split-second coordination, plus an eye for mazes. In that regard, Coleco's cartridge is no different from the original.

Players of the arcade game will be quick to tell Coleco's from the original, however. For one thing, there are only three different boards, instead of four (the easy Mud Factory scene is gone). But

continued on page 10

VIDEOGAMES

continued from page 8

even so, the game is perhaps the most true-to-arcade home-videogame cartridge around.

The graphics are outstanding. You not only can see Mario's mustache, but the lattice work in the bright pink girders is crisp, and the color variations and contrast (the black background helps), like Mario's brown coveralls, and the white streaks to indicate cylindrical objects, are unlike that found on any other home game I've seen. And the sound package includes the familiar background rhythm, whistle-like tune when Mario hops over barrels, and more.

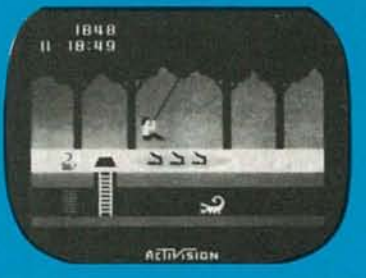
One or two (alternating) can play at a time and there are four levels of difficulty; the easiest one starts you off with five Marios, the rest start with three. Completing skill level one (the easiest one) requires rescuing the girl five times. The sequence of board scenes is Ramps, Rivets, Elevators, Rivets, and Elevators. At level one you also get 1000 extra bonus points, which gives you more time to navigate the trickier obstacles (the bonus points decrement as time ticks away) The game can be reset from the hand controllers.

While it's not hard to learn what *Donkey Kong* is all about, the newcomer, nevertheless, will need a lot of practice to get the hang of running and jumping over the moving and stationary obstacles (make a mistake and you lose your Mario). You'll also discover several areas that can be tricky; especially watch out for the edges of girders (Mario can easily fall off to his demise) or the area around Kong.

The Elevators board is the most difficult to get used to. Arcaders may be interested to know that the bouncing hammer obstacles are replaced in the home version by an extra flame at the girder levels surrounding the girl.

While some of the charm of the original—like Kong's grabbing the girl between boards and watching the girders collapse in the Rivets board—had to be sacrificed for the smaller memory of a home game, Coleco managed to keep some of the "cute" effects (Mario can pick up the girl's scattered personal belongings for bonus points) and interest of the original where it counts; while you're playing the game. This first offering for *Colecovision* is certainly a good omen for the rest of their library.

Activision's Pitfall! for Atari



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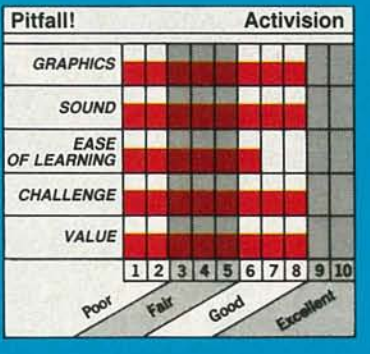

I wouldn't have believed it could come from an Atari *VCS* if I hadn't been watching it with my own eyes: a comic-book human character is running across a jungle-like scene, swinging on vines over a pond, leaping over pit-like traps, climbing up and down ladders, and finally tiptoeing across a lagoon on the heads of hungry crocodiles.

The game is *Pitfall!* from Activision (3255-2 Scott Blvd., Santa Clara, CA 95051), and the character's name is Pitfall Harry. What Harry is doing is searching the jungle for as many of the lost treasures of Enarc as he can in twenty minutes without giving up his own life to scorpions, quicksand, and those darned crocodiles, to name a few. Every time he runs off the screen, a new scene appears with different hazards—in fact, 256 different scenes have been programmed into the cartridge.

Design of this solitare game is attributed to Activison's David Crane (thus the treasures of Enarc) and is one of the most original and graphically interesting *VCS* cartridges available. The sound package even includes an electronic Tarzan call while Harry swings on a vine. The novice player will need some time to get the coordination down to run and jump for swinging vines, race over vanishing pits, jump over several obstacles, and gingerly dance across the crocodile lagoons.

What's most interesting about this game is that no matter how good you get at avoiding obstacles, you're never quite sure that you haven't missed some underground passage shortcut (jump over scorpions down there) or have found the fastest way to overcome an obstacle (like making it over the crocodile lagoon in one mad rush while the crocodiles' mouths are shut). Expert players will be glued to the set for hours, experimenting and memorizing successful patterns.

You'll have to work hard to reach the first treasure (a money bag)—perhaps a minute and a half—but the longer you keep Harry alive, the quicker he'll find the others (rings, silver/gold bars, etc.). So be prepared for a twenty-minute adventure each time you reset.

Also available from Activision is a version of *Pitfall!* for Intellivision game systems. Although the graphics might be a letdown when compared to other Intellivision games, the game play certainly won't be. *Pitfall!* is a stimulating adventure game on any system. **R-E**

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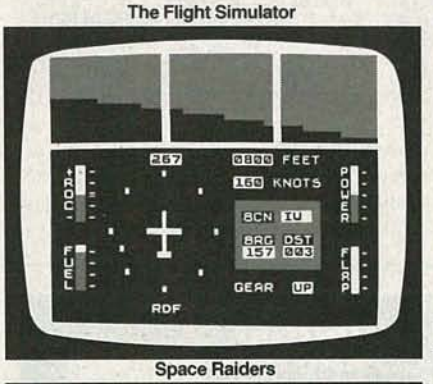

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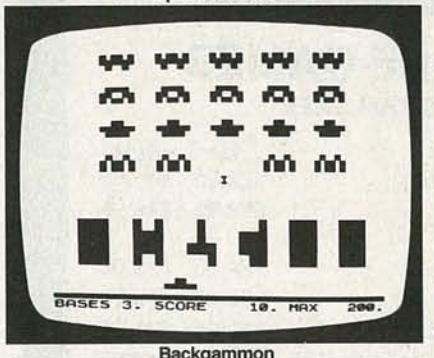

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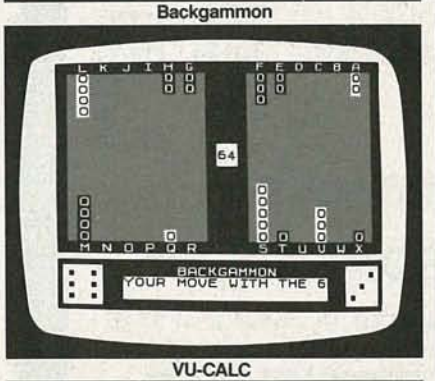

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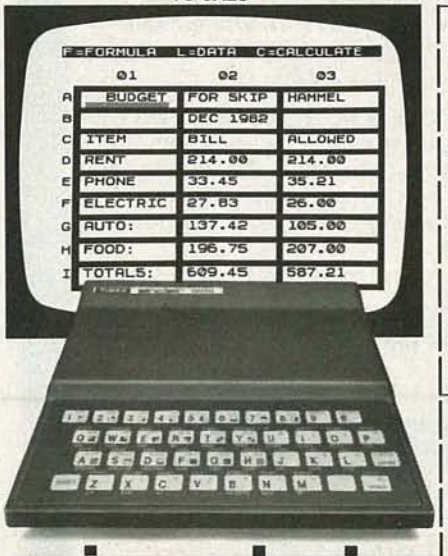

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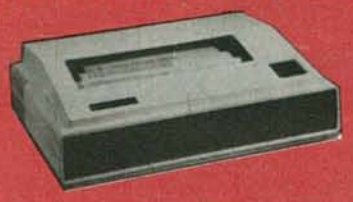

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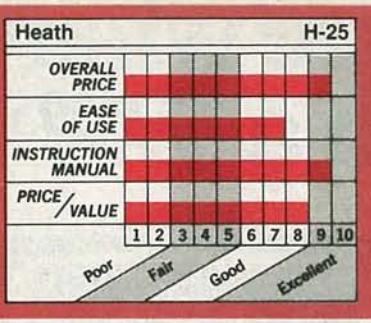


MOST READERS OF **RADIO-ELECTRONICS** have assembled at least one Heathkit, and are familiar with their "goof-proof" instructions, large illustrations, and easy-to-comprehend steps. Up until very recently, the emphasis was towards electronic devices ranging from simple test equipment to full-function, digital computers—with a host of things in between. The *H-25* Dot Matrix Printer is not your usual step-by-step, solder R13 to J4 on P9 type of manual or kit; instead, it is primarily a mechanical assembly with, to say the least, very little electronics assembly involved.

If you have ever examined the inside of a printer, be it a daisy-wheel or dot matrix, you were immediately aware of the fact that, regardless of the manufacturer, the printer was heavily oriented towards mechanical assemblies, and perhaps compressed the electrical/electronics section to a small printed-circuit board.

Essentially, we have just described the "generic" printer, but there is nothing "garden-variety" or plain about the *H-25*. It is specified as a high-speed dot-matrix printer capable of speeds of up to 150 chracters-per-second and handles paper from label size to the oversized forms we are used to seeing in commercial computer installations. What sets this printer apart from the standard Heathkit line is the fact that the *H-25* kit, like other printers currently available, is primarily mechanically intensive in design and assembly.

The kit comes in two boxes, one small and one large. The smaller box, by the way is the heavier of the two. The large box contains the molded cabinet, chassis, and power transformer. The smaller box contains the internal workings and parts that make up the final printer. Of particular interest is the method in which those boxes are packed and the parts identified. There is a chart that you will find as soon as you open the box with a "map" of sorts telling you precisely where each pack of parts is located and its identification number. That permits you to unpack only those components you will be working with, and allows the kit-builder the option of using any convenient work surface—even the kitchen table—to build the printer on.

Assembly is broken into small-easy-to-handle stages with the first being the assembly of the Circuit Control Board. That small printed-circuit board contains the control panel that allows you to select: on/off line; forms alignment; top of form; buffer clear, and reset. The board is probably the most electronic-intensive portion of the entire kit, and requires less than an hour to complete. There really isn't all that much to it as it consists of a few LED's, an IC, and some switches, together with a flat cable assembly.

The electronics assembly is now essentially over. The first phase of the mechanical assembly centers around the assembly of the carriage, with the bearings and other components that form the mechanics of the carriage and stepper-motor for the print-head assembly. Those were no surprises and the mechanical assembly was well-supported by an almost lavish use of illustrations.

Moving right along, the assembly steps

One of the most notable features of the computerized flight deck is its level of redundancy. For instance, not only is there one FMC for the pilot, but there is another for the co-pilot. The plane can fly with either FMC or manually.

If a major failure should occur, then backup liquid-crystal-display gauges and dials take over and provide critical readouts in place of the FMC.

Other subsystems

While the linchpin of the system is the FMC, there are other subsystems that are also important. Take the Flight Control Computer, for example. It receives inputs from the Inertial Reference System (IRU), the Flight Management Computer, the Thrust Management Computer, the Air Data Computer, the Radio Altimeter (RA), the Instrument Landing System (ILS), and the Control Wheel force transducers.

The Flight Control Computer commands the airliner's control surfaces (flaps, etc.) and engines, and responds to changing conditions by automatically altering their settings. Thus, if it appears that it would be more economical to fly over a storm than through it, the Flight Control Computer causes the plane to climb and bank in response to the new inputs.

While that is taking place, another segment of the system—the Thrust Management Computer—is computing and displaying autothrottle functions. It integrates signals from the engines, Air Data Computer, Thrust Mode Selector Panel, Flight Management Computer, and the throttle to provide autothrottle functions for all flight conditions.

For instance, with the throttles at full forward, the Thrust Management Computer provides maximum allowable engine power without exceeding operating limits. Further, performance management functions are performed in concert with the FMC, Autopilot Flight Director System, and other systems. Throttle changes during command operations, such as flight level changes, are performed automatically. And, in the event of a missed approach, the Thrust Management Computer provides the maximum allowable thrust when go-around is commanded by the flight crew.

Of even more interest from a technical standpoint is the new Inertial Reference Unit (IRU). While many people are somewhat familiar with the typical gyrocompass, the IRU uses a laser-controlled gyro for positioning. Unlike the traditional gimballed gyrocompass, there is only one moving part.

Called a Ring Laser Gyro, it uses a split laser-beam travelling in opposite directions around a closed triangular path. When angular motion is introduced, a frequency difference is detected and measured by photodiodes. That is converted to a digital output for use in the IRU computer. Three laser gyros are required for each IRU system, one for each axis.

In the align mode, the IRU is able to align itself to the local vertical, true north and an estimated latitude by gyrocompassing. No heading reference is required, because the IRU analyzes the spin vector generated by the earth's rotation to compute true north. Initial positioning must be entered through the Inertial Reference Mode Panel (IRMP). However, the last position of the previous flight can also be used to allow the IRU to compute a magnetic heading. The IRU also provides similar functions for navigation and attitude.

From all of that you can appreciate the level of sophistication needed not only in the hardware, but also the software. The programming for the Flight Management Computer alone took more than 100 man-years to create, test, and debug. It was then sent through exhaustive testing not only by the Boeing Co., but also by the Federal Aviation Administration.

It is a highly structured program, says Larry Bowe, head of engineering for Sperry Flight Systems, developer of the FMC. It's also a very capable one. It's possible for a pilot to program route and destination into the FMC and then let the computer fly the plane from takeoff to touchdown. Further, it will also alert the crew via the Engine Indication and Crew Alerting System that something is amiss in time for the pilot to take over.

The beauty of the total package is that it frees the pilot from many of the chores that he used to do manually. No longer does he have to compute the weight, temperature, weather, wind, and other parameters for a takeoff. With a few button pushes, the system does it for him. Long, in-flight computations are also eliminated. Thus, the pilot can now become a flight manager.

Pilot reaction

Pilots are ecstatic about the results. They like the displays and the possibility of using less fuel. They also like the Boeing "quiet, dark cockpit" concept, in which indications of system operations are reserved for conditions that require actions by the flight crew. There are very few distracting lights that signify normal operation on the flight deck.

In addition, the major functions of operation, status, and maintenance have been separated so they may be brought to the attention of the flight and ground crews selectively as they are needed.

So, what began as an attempt to save fuel by the airline industry has now turned into possibly the best aircraft in the air. In fact, if you fly on it, you'll never know whether the computer or the captain is doing the work.

Next month we'll present a detailed description of the displays and major subsystems of this system. **R-E**

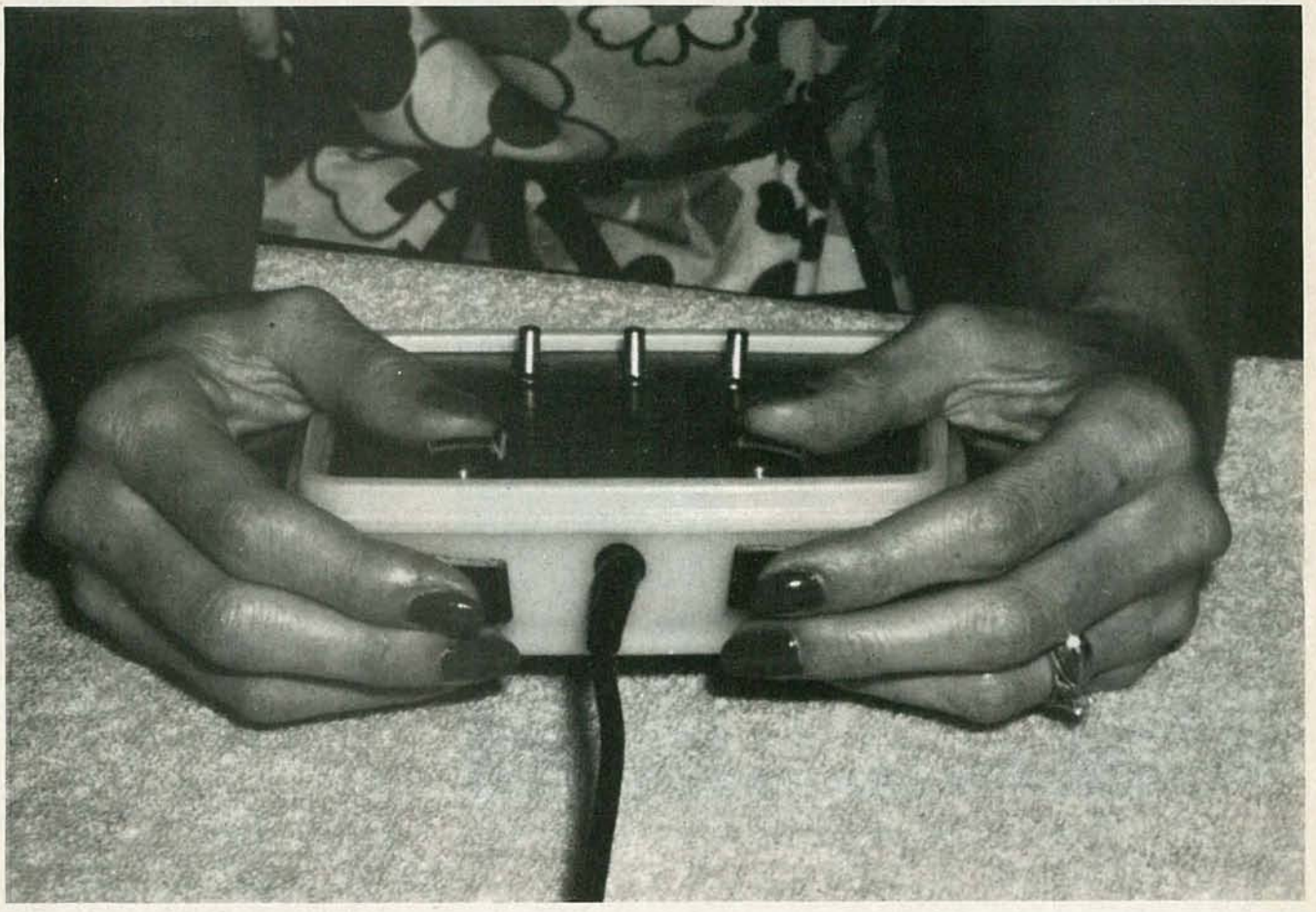
BUILD

Atari Videogame Controller

Add excitement and high scores to your home videogame. This easy-to-build joystick replacement for your Atari VCS gives you improved control plus a rapid-fire option and a tilt-activated fire switch.

DAVID J. SWEENEY

IF YOU ARE THE PROUD OWNER OF AN Atari *VCS* home videogame, you've probably spent more than a few evenings at home nursing a pair of rather sore hands. The reason why is that the Atari joysticks, which despite their shortcomings are still considered to be among the best available, are built to endure the excitement and pressure generated while shooting down those Space Invaders, or what have you, but your hands most certainly are not. Partially because of that, and partially because videogame players are always on the lookout for anything that might help improve their score, a whole industry (although, granted, a small one) devoted to supplying aftermarket game controllers has sprung up. Most of those, however, are simply better (we hope!) joysticks. What about a different approach? The joystick replacement described here, which, incidently, does not resemble a joystick in any way, will add a new dimension to your home videogame action. Among its advantages are that it is easily built, comfortable to use, and adds a couple of features not found in the standard Atari units—those are repeat-fire action and a tilt-controlled switch. What's more, the project is very economical to build and operate.



A SANDWICH BOX covered with wood-grained paper makes an inexpensive case.

Comparing the controllers.

The controller that is supplied with the Atari videogame system (see Fig. 1-a) uses five compression switches to control the game action. Four of those switches are operated by the joystick; the fifth is controlled by the red FIRE button; for simplicity's sake, we'll call those five switches UP, DOWN, LEFT, RIGHT, and FIRE (see Fig. 1-b). All of the switches are momentary, normally open, SPST types. Game software is designed so that the action on the screen is controlled by the opening and closing of those switches, which, in turn, is controlled by the movement of the joystick. In other words, if you move the joystick to the left, it will close the LEFT compression switch (more on that shortly), and the software will move the appropriate object (gun, ship, Pac-Man, etc.) to the left; moving the joystick up will move the object on the screen up, etc. Moving the joystick diagonally closes two switches at once, moving the object diagonally.

Any joystick substitute must also provide an arrangement of five switches. This device uses four pushbutton momentary SPST switches and one internal tilt-controlled mercury switch. Figure 1-c shows the location and function of those

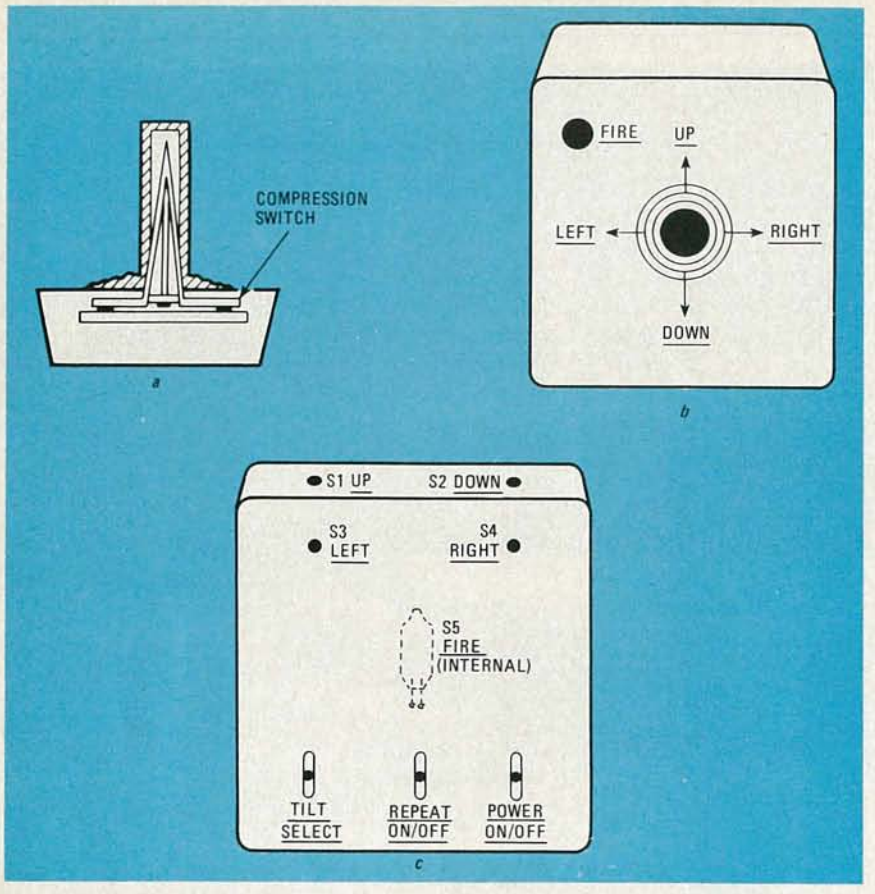


FIG. 1—ONCE YOU GET USED to the switch positions on the controller you're likely to throw your original joysticks away!

TABLE 1

	Switch	Location/Function	Joystick equivalent
Game switches	S1	Left forefinger	Up or Fire*
	S2	Right forefinger	Down
	S3	Right thumb	Left
	S4	Left thumb	Right
	S5	Internal	Up or Fire*
Setup switches	S6	Power on/off	—
	S7	Repeat on/off	—
	S8	Tilt select	—

*Selected by S8

switches, as well as the unit's three others—POWER ON/OFF, TILT SELECT, and REPEAT ON/OFF. Note that the Atari joystick's UP, DOWN, LEFT, RIGHT, and FIRE switches are replaced in our new controller by S1, S2, S3, S4, and S5 respectively. However, the function of two of those switches (S1 and S5) can be interchanged by using the TILT SELECT switch. That lets you choose whether you want to use the tilt switch (S5) to control firing or the upward movement of the object on the screen. Needless to say, whichever function is not controlled by the tilt switch will be controlled by S1. The switch functions/locations of our substitute controller, and their corresponding joystick functions, are summarized in Table 1.

As you can see in Fig. 1-c and the photos, S1-S4 are located so that they can be easily pushed by your forefingers and thumbs when the controller box is held. You're sure to find that this setup will make playing almost any game less tiring, and more enjoyable.

The circuit

The schematic diagram of the replacement controller is shown in Fig. 2. Aside from the switches we've already discussed, the bulk of the circuitry involves the repeat mode. Switch S7 is used to select either that or the single-shot mode.

In the repeat mode, you no longer need to push a button each time you want to fire a shot. Instead, each time you press the FIRE button or tilt the controller, depending on how the TILT SELECT switch is set, shots are fired at a rate of about 10-per-second for as long as the fire switch is pressed or the unit is tilted. The circuit used to do that is relatively simple, involving mainly a 555 IC oscillator and a reed relay. Basically, the oscillator is configured to open and close the relay at a rate of 10 Hz which, is about the fastest rate that you achieve manually. There is one other thing we should point out here: some games limit the number of shots you can take at a time—in Space Invaders, for instance, you can not take a second shot until the first has completely cleared the screen. Our controller can not override the software and change that.

Construction

Building our videogame controller is almost easier than describing it; it involves little more than installing the switches and repeat-mode circuitry into a suitable case. Let's turn our attention to that case for a moment. Considering the simplicity and low cost of our controller, it would seem a waste to house it in something that would cost more than the device itself. But, on the other hand, some sort of attractive case would be desirable. We decided upon a rather nice, if unlikely, compromise. The case you see in the photographs is nothing more than a refrigerator sandwich box, the kind that you can get in any discount store or supermarket; we dressed it up a little by putting some wood-grained self-adhesive paper on the lid. In use, we found that the case is easy on the hands and that it stands up well to the stress and perspiration sure to be generated when playing any videogame. In fact, the case has withstood eight months of hard use by a variety of players with no visible bad effects.

One problem did develop concerning the switches. First of all, they are rather small and easy to miss in the heat of "battle." Also, use over extended periods of time resulted in quite a bit of wear and tear on the fingers. The solution to both those problems was rather simple—an old belt was cut into strips that were used as switch covers. The strips (which measure 1 × ½ inch) are installed simply by punching a hole in one end and screwing them down next to the pushbuttons so that they lie over them.

The repeat-mode oscillator can be built using any construction technique and parts placement is not critical. The oscillator used in the prototype was built on perforated construction board and point-to-point wiring was used. The mercury TILT SELECT switch is mounted on the oscillator circuit board using a Velcro fastener as shown in Fig. 3. That mounting technique was used to allow for easy switch replacement in the event that it ever becomes necessary. The battery holder was made from a strip of aluminum that was shaped to fit the battery and secured as shown.

PARTS LIST

All resistors ¼-watt, 5%, unless otherwise specified
R1, R2—150 ohms
R3—47,000 ohms
R4—10,000 ohms
Capacitors
C1—2.2 μF, 50 volts, electrolytic
Semiconductors
IC1—555 timer
RY1—5-volts DC relay (Radio Shack 275-240 or similar)
S1–S4—SPST normally-open pushbutton
S5—mercury switch (Radio Shack 275-027 or similar)
S6—SPST toggle
S7—SPDT toggle
S8—DPDT toggle
B1—9-volt battery
Miscellaneous: cord from Atari joystick, case, perforated construction board, hardware, strain relief, battery clip and holder, etc.

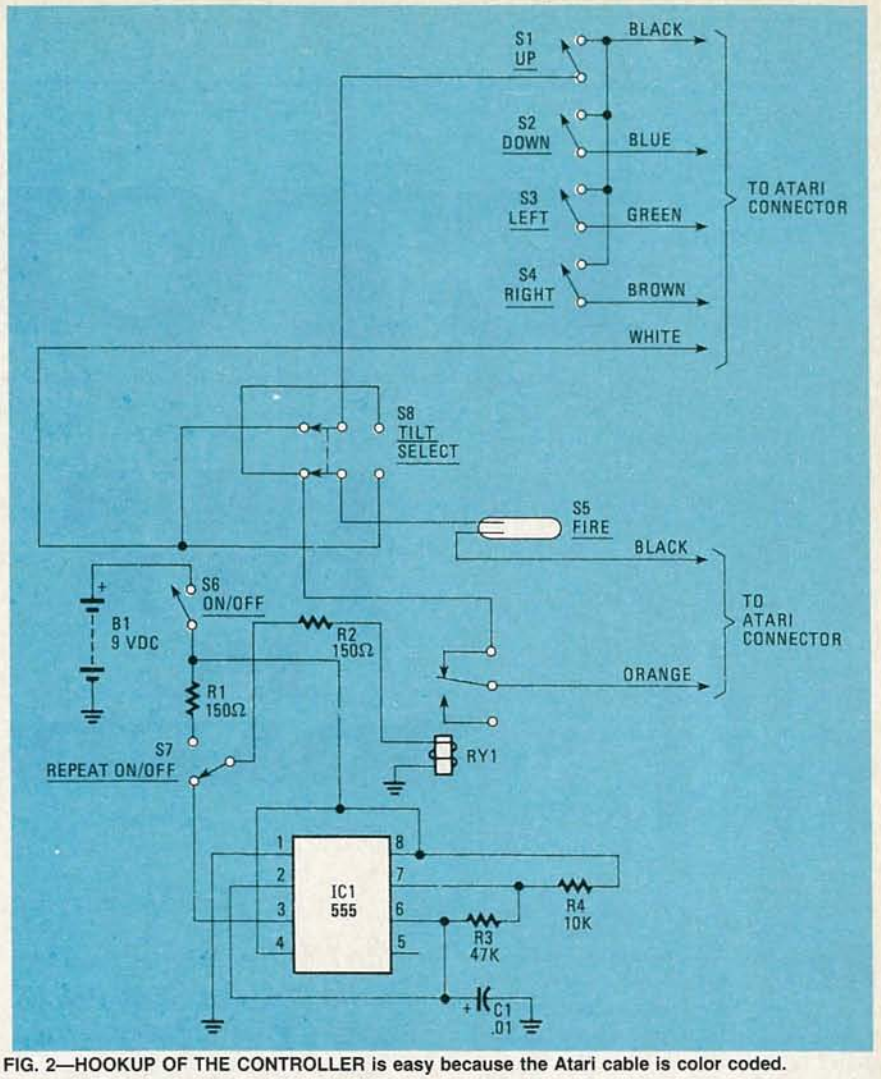


FIG. 2—HOOKUP OF THE CONTROLLER is easy because the Atari cable is color coded.

Before installing the oscillator in the case, check it for proper operation. The easiest way to do that is to apply power and check to see if the relay opens and closes at a rate of between 8 and 10 times-per-second. Also, it is very important to make sure that there are no shorts in the circuit. Keep things as neat as possible—if the nine-volts from the battery were somehow applied to the controller's outputs, costly damage to the Atari console might result.

Hooking it up

To attach the controller to the console, you can use the cable and plug from an old controller, or you can make up your own 6-conductor cable. If you would rather not cannibalize a controller and wish to make your own connector, the pinout diagram shown in Fig. 4 can be used to help you wire a standard DB-9S socket for direct connection to your Atari console. (Note that both black wires in Fig. 2 are connected to the same terminal on the DB-9S.) In either event, the multiconductor cable should be connected to a terminal strip as shown in Fig. 3, and all subsequent connections should be made from that strip. As always, be sure to provide some type of strain relief for the cable where it enters the case.

Aside from the relief the controller provides for your hands, the tilt switch and the repeat function allow you to play almost any game more aggressively. The sensitivity of the controller could pose a problem in games that require a light touch, such as Activision's *Skiing*, but should help you get higher scores when you play most other Atari-compatable games. You'll need a bit of practice to master the different motions required by the controller, but once you do, and once you see the kind of scores you'll be running up, you'll probably never go back to the standard Atari joysticks. **R-E**

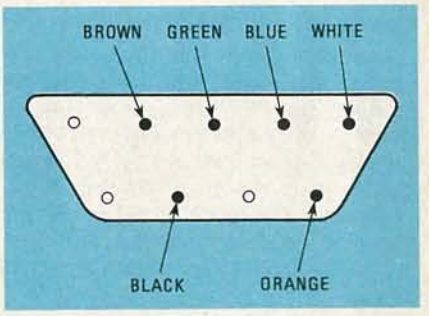


FIG. 4—THIS PINOUT of the socket on the Atari joystick cable can help you to wire your own DB-9S socket.

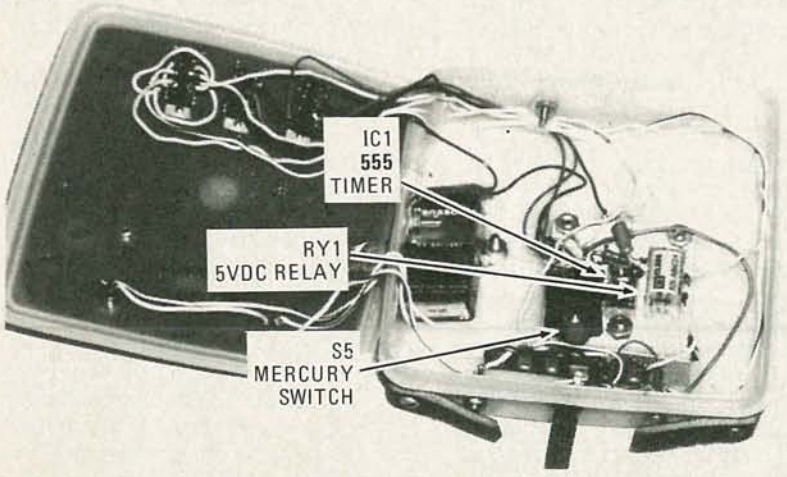


FIG. 3—TILT-SWITCH SENSITIVITY can be made adjustable by mounting the Velcro fastener on the wall of the case instead of on the circuit board.

FM-3000 lists for $34.95.—**Winegard Company,** 3000 Kirkwood Street, PO Box 1007, Birlington, IA 52601.

AUTORANGING CAPACITANCE METER, *Model 3002,* combines the precision, range, and flexibility of benchtop models with the convenience and efficiency of a handheld portable unit. The unit weighs only twelve ounces and measures 7.6 × 3.75 × 1.72 inches. The digital LCD readout provides direct readings of capacitance from 1 pF to 199,900 μF, with 8 automatically selected ranges providing accurate measurements of capacitance without manual switching. Designed with dual threshold detectors, the *Model 3002* is accurate to 0.2% ±1 count in the 1 pF to 199.9 μF range and 1.0% ±1

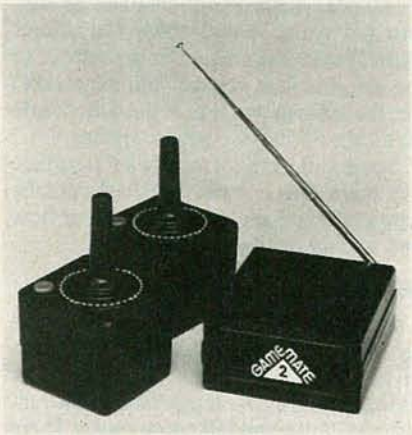
CIRCLE 129 ON FREE INFORMATION CARD

count in the 200 μF to 19.99 mF range.

The dual threshold measurement technique eliminates reading errors due to dielectric absorption. By using DC charging characteristics to determine true capacitance, the *Model 3002* can determine capacitance in cables, switches, and other electronics components and hardware, in addition to capacitors and capacitor networks. The front panel contains power ON/OFF and zero-calibration thumbwheel controls and both banana jacks and special low-insertion-force jacks. Low power consumption (maximum 75 mA) assures long battery life (16 hours of continuous operation).

The *Model 3002* operates on 6 AA batteries, or may be powered by an optional AC adapter/charger. A flip-up leg allows the user to see the LCD readout and operate controls easily while the unit is on a work bench. The *Model 3002* is priced at $210.00.—**Global Specialties Corporation,** 70 Fulton Terrace, PO Box 1942, New Haven, CT 06509.

JOYSTICK SYSTEM, *Game Mate 2,* is a remote-control joystick system for Atari, Sears, and Commodore videogames and home computers. The system lets you play videogames from 20 feet away, without requiring wires running along the floor. It is easily installed; just plug it in.



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The *Game Mate 2* has a suggested retail price of $99.95.—**Cynex Manufacturing Corp.,** 28 Sager Place, Hillside, NJ 07205.

SOLDERING SYSTEM, *Model 9000,* allows tip temperature to be varied from 420° to 800°F with a resolution of ±10 degrees. Solid-state circuitry, including the newest microcircuit IC's, sample the tip temperature 120 times-per-second. LED's on the temperature controller instantly display each 20-degree temperature increment reached, creating a bar chart that clearly represents the tip temperature to within ±10°F.

The heating element, which combines a heater and sensitive tip-temperature sensor, recovers tip temperature after each solder joint. The smaller heating element also makes possible a thinner handle that is cooler than other models.

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Electronic circuitry in the controller prevents tip-temperature overshoot that could easily cause faulty soldering. The controller can be calibrated by a front-panel adjustment, using room temperature as a reference. For ultra-precise soldering, any temperature within the temperature range can be calibrated to be accurate within 5°F.

The *Model 9000* is priced at $150.00.—**Ungar Division,** Eldon Industries, 100 W. Manville St., Compton, CA 90220. **R-E**