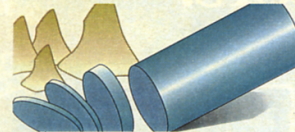


# From Dust to Desktop

The manufacture and distribution of a Macintosh involves hundreds of workers from many companies worldwide.

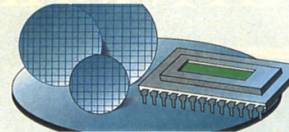
BY STUART SILVERSTONE

**Silicon**, a pure type of sand and the second most abundant element on Earth, is the ingredient that has made microcomputers possible. It and other raw materials, such as petroleum for plastics and ore for metals, are transformed into their refined states for the internal parts, chassis and case of a Mac.



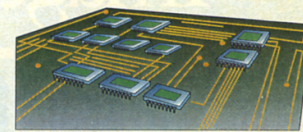
The silicon is melted, drawn and crystallized into a cylinder, sliced into thin wafers, then polished, oxidized, etched and diced before being mounted in a protective ceramic or plastic carrier as a chip.

**Chips** each contain tens of thousands of electronic circuits made of silicon or other semiconductor materials that can be electronically controlled to conduct current when "on" or resist it when "off." In combinations with one another, the switches can create AND/OR series for processing Boolean logic.



Very large-scale integrated (VLSI) circuits contain up to 1 million components.

**Boards** use a fiberglass base to combine a series of chips interconnected through multiple layers of conductive trails of copper. The Mac's logic board, for example, includes memory chips; input/output communications chips; and the CPU, the Motorola 68030 microprocessor chip for the Mac IIx.



The CPU's arithmetic and logic unit achieves great computing power by performing only four functions: It adds, subtracts, moves and compares information thousands of times per second.

**Assembly** of hundreds of components, both off the shelf and fabricated to proprietary design specifications for the Mac, takes place at Apple's state-of-the-art manufacturing plant in Fremont, Calif.

**Components** are delivered on reels, trays and plastic tubes that load into carousels of automatic component insertion equipment or vibrator feeder bowls that robot arms will handle.

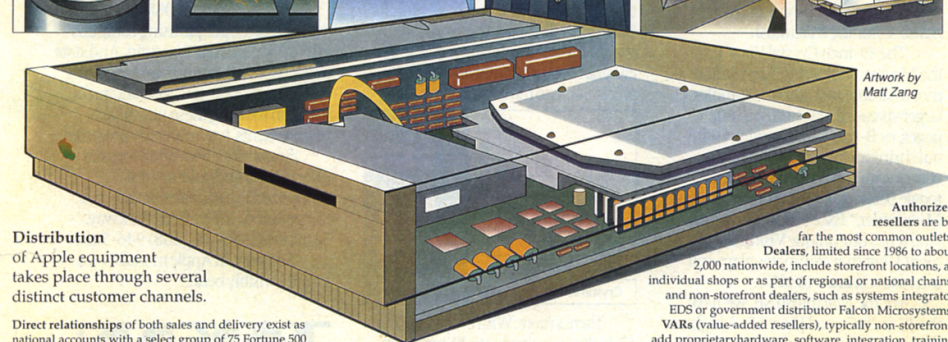
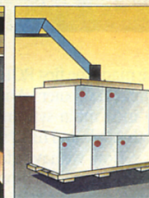
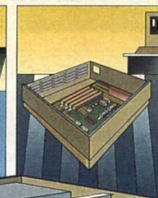
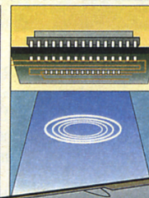
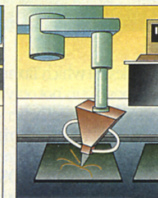
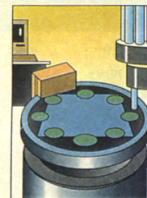
**Mounting** of components by the insertion equipment and robots also includes the automated use of epoxy, solder pastes and curing ovens.

**Soldering** occurs in a wave process where the boards skim through a reservoir of liquid solder, connecting the chips to the trace wire pattern on the board and achieving a strong mechanical bond.

**Assembling** the entire computer starts with inserting the logic board in the Mac's metal shield liner, bridging it with the chassis and adding power supply, hard drive, floppy drive and case cover.

**Control** of the assembly process is managed in part by Macs and includes testing the functions of the boards, a final, self-regulated, burn-in that lasts about 20 hours and a five-part, state-of-the-art quality assurance program.

**Shipping** occurs after the completed units are boxed and placed on pallets. Two shifts per day, each of more than 900 workers, produce about 5,000 Macs. Inventory of units is avoided by building to a demand forecast.



Artwork by  
Matt Zang

**Distribution** of Apple equipment takes place through several distinct customer channels.

Direct relationships of both sales and delivery exist as national accounts with a select group of 75 Fortune 500 corporations and about 200 of the country's largest universities, which need technical support for integrated multivendor systems and whose use of Apple equipment serves as a visible endorsement to stimulate demand from other customers.

Direct sales occur with all K-12 educational customers, whereby authorized Apple dealers follow up with setup, training and orientation functions.

Warehouses at three locations and 30 regional sales offices that offer marketing, sales, technical support and training comprise Apple's infrastructure around the United States.

Authorized resellers are by far the most common outlets. Dealers, limited since 1986 to about 2,000 nationwide, include storefront locations, as individual shops or as part of regional or national chains, and non-storefront dealers, such as systems integrator EDS or government distributor Falcon Microsystems. VARs (value-added resellers), typically non-storefront, add proprietary hardware, software, integration, training or some other value to Apple equipment before selling it, typically to vertical-market customers. OEMs (original equipment manufacturers) are vendors whose product, such as Sun Microsystems' version of the LaserWriter, loses the Apple label and identity.

an 11x17 tabloid page in a computer weekly is an early **visual journalism** example of **telling a story** with words and images integrated in a **poster-like display**

explaining the manufacturing process and the parts inside a then-new computer in a **hierarchy of illustrative visuals** and **chunks of text elements** that invite **skimming** and numerous entry points —perhaps even full **reading**