

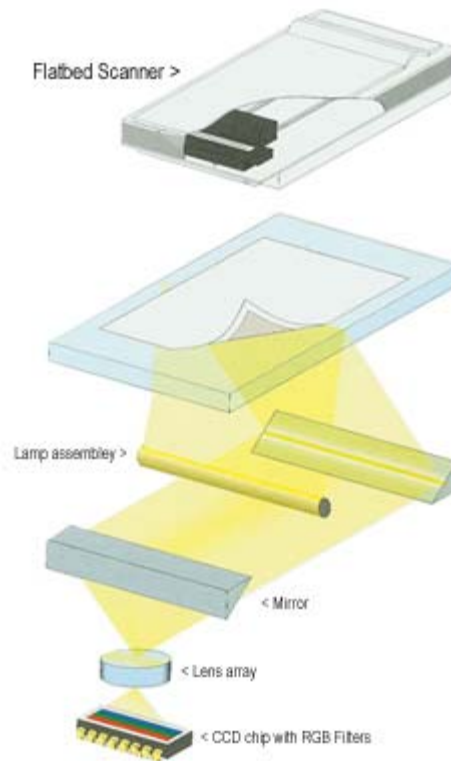
## Selecting Scanners

Scanning can be done in-house or contracted out. The cost-effectiveness of each approach will depend on the volume, type, and fragility of materials being scanned, the required quality of the resulting digital objects, and the expertise and equipment available in-house. The economics of this equation will change with market conditions and technological advances. In making this decision, it can be helpful to know something about the strengths and weaknesses of the various types of scanners available, in order to assess their appropriateness for any particular imaging project or strategy. However, be aware that scanner selection is only one factor affecting the success of a digitizing project. For instance, any area where high-quality scanning will take place should have controlled lighting (no natural light) and continuous gray-tone walls, ceiling, and floor and be free of dust and vibrations. Service bureaus offering image capture vary considerably in the quality levels they provide, and should the decision be made to outsource digitization, a variety of sample images should be sent to several vendors, and the quality of the resultant scans compared before digitization is begun.

There are four general types of scanners: **drum** (fig. 9), **flatbed** (figs. 7, 10), **film or transparency** (fig. 11), and digital camera (essentially a traditional still camera with scanner technology attached to it, or a "scanback") (fig. 8). Most scanners use **CCD** (charge-coupled device) light-sensitive image sensors, though the newer CMOS (complementary metal oxide semiconductor) technology is making some inroads in lower-cost and lower-quality mobile applications. Scanning is a process that generally resembles photography or photocopying, and in fact it is advisable to use the services of a professional photographer for image capture, if possible, to ensure the highest possible quality of reproduction. Depending on the type of capture device, the work to be captured may be placed either in front of a digital camera (on a stand or tripod) or on or in a scanner. A shot is then taken, but instead of exposing the grains on a piece of negative film or on a photocopying drum, light reflects off (or through) the image onto a set of light-sensitive **diodes**.

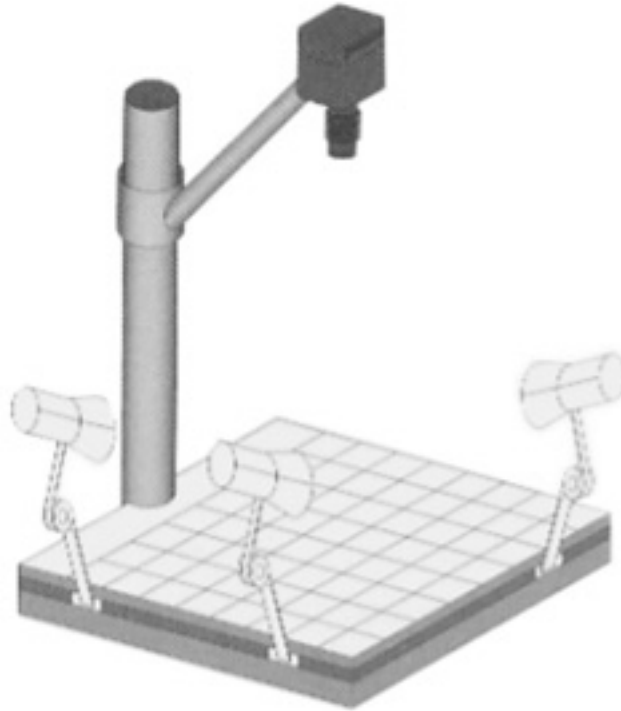
Each diode responds like a grain of film, reading the level of light to which it is exposed, except that it converts this reading to a digital value, which it passes on to digital storage or directly into computer memory for editing and other postcapture processing. Rather than exposing the entire image at once, the diodes may sweep across the source image, like the light sensors on a photocopying machine. The number of distinct readings, taken vertically and horizontally, determines the resolution of the scanned image. The possible range of values that can be recognized by the digitizing hardware is the dynamic range of the device, which helps determine the maximum sample depth of the resultant images. (As of this writing, the chosen scanner should have a minimum bit depth of 36, but a bit depth of 42 or 48 may be preferable.)

Fig. 7 Components of a flatbed scanner



The hardware device (i.e., the scanner) functions together with its driver (the program that allows a peripheral device such as a scanner to interface with a computer's operating system) and its managing application program or software, and each of these three elements will have an impact upon image quality. It is possible to use third-party scanning and editing software for postscanning image manipulation rather than the program that comes bundled with a scanner. Such software should be chosen on the basis of its ability to perform required tasks, such as saving image files into the needed variety of formats and compression schemes (for instance, TIFF, GIF, JPEG/JFIF, PNG, JPEG2000, and LZW), or converting images from one format to another. Another important capability is **batch processing**, the ability to apply a given process—such as compression, the creation of thumbnail images, or the addition of a **watermark** or copyright notice—to multiple files. (Note that such capabilities may be needed in-house even if a service bureau does the original image capture, and also that some may be provided by DAM systems, perhaps linking to third-party software.) A manual override for any automatic scanning function is also essential, as any system will occasionally misjudge material. Using hardware and software that support ICC color profiles enables the scanner and monitor employed to be calibrated to the same settings and helps ensure color fidelity and consistency. Be aware that such capabilities may be needed in-house even if a service bureau does the original image capture, and also that some may be provided by DAM systems, perhaps linking to third-party software.) A manual override for any automatic scanning function is also essential, as any system will occasionally misjudge material. Using hardware and software that support ICC color profiles enables the scanner and monitor employed to be calibrated to the same settings and helps ensure color fidelity and consistency.

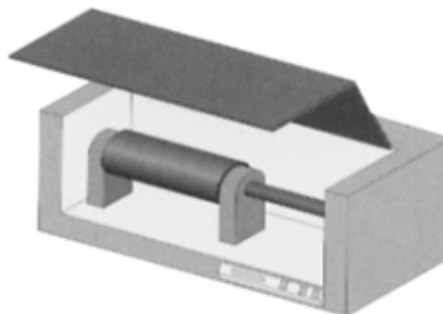
Fig. 8. Digital camera attached to an adjustable copy stand



Digital cameras are the most versatile capture devices. Attached to an adjustable copy stand (similar to a microfilming stand), the camera can be moved up or down in order to fit the source material within its field of view. This allows the scanning of materials larger than most scanners can accommodate and does not require direct contact with the original, which may be an important conservation concern. Moreover, digital cameras allow more control over lighting and setup than is possible with scanners, and can also capture images of three-dimensional objects rather than being limited to documenting two-dimensional originals or analog surrogates. However, high-quality digital copy-stand cameras are expensive, and the more portable and affordable handheld consumer cameras cannot offer the same quality of image capture. The choice of a digital camera can eliminate the often-laborious workflow step of creating analog photographic intermediaries such as negatives or transparencies. This will save time but will not provide an additional, robust surrogate of the originals.

Drum scanners resemble mimeograph stencil machines from the 1960s; source material is placed on a drum that is rotated past a high-intensity light source during image capture. Drum scanners use traditional photomultiplier tube (**PMT**) technology rather than CCDs. They tend to offer the highest image quality, up to 8000 samples per inch (spi), but require flexible source material of limited size that can be wrapped around a drum, which may be a serious conservation concern and may require the use of analog photographic intermediaries. Drum scanners are expensive as compared to most other scanner types. ("Virtual drum" scanners, which use CCD technology and a crafty arrangement of mirrors, are more affordable but cannot approach the same resolution.)

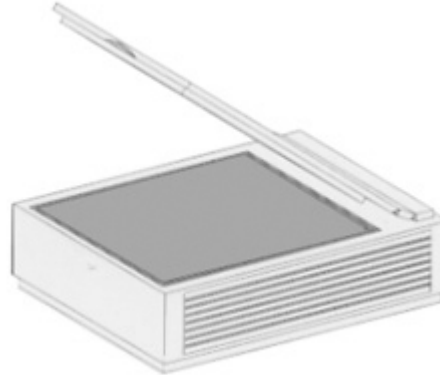
Fig. 9. Drum scanner



Flatbed scanners are highly affordable and resemble photocopying machines; source material is placed flat on the glass and captured by CCD arrays that pass below it. Newer scanners generally have a resolution of

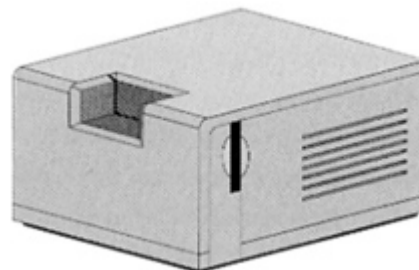
between 1200 and 5000 spi, depending on their price and quality. Flatbed scanners require source material to be no larger than the scanner's glass and to lay facedown and flat in direct contact with the scanner, thus making them impractical for fragile or oversize materials. Many flatbed scanners now come with built-in slide or transparency holders, and transparency adapters can be easily purchased if such devices are not included. These may allow multiple transparent images to be scanned at a time, if each image in a strip has the same color and resolution requirements. However, if one cannot invest in an expensive, top-of-the-line flatbed scanner, transparency scanners can generally achieve higher-quality image capture from transparent material.

Fig. 10. Flatbed scanner



Transparency scanners generally resemble small boxes with a slot in the side big enough to insert a 35mm slide, though multiformat or 4-by-5-inch scanners are also available. Inside the box, light passes through the transparency to hit a CCD array. Transparency scanners are designed to scan small areas at high resolution. They can offer resolution comparable to that of a mid- to high-end flatbed scanner and are highly affordable.

Fig. 11. Film or transparency scanner



The nature and characteristics of the source material should be examined to determine what limitations they impose upon scanner selection. Will capture be from the original work or from a photographic reproduction? How fragile or robust is the source material? Is it transparent or reflective, two- or three-dimensional, or pliable enough to wrap around a large drum? Once the range of scanner types has been narrowed, a choice must be made among the features and capabilities of various models, noting such characteristics as ability to support ICC color profiles, maximum possible resolution, and sample depth.